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AM I MY BROTHER'S KEEPER?

ACCIDENT RATES are rising in most industries today. Both in severity and frequency, industrial accidents are exacting a heavier toll in loss of life and limb. Why must the speeding up of the industrial machine be accompanied by this rising tide of human casualties? Reasoning solely from the records of past depressions, one might hold that this is the inevitable price of business recovery. Yet when you go behind the figures and study the nature of recent accidents, it becomes apparent that they are not due to any new causes or conditions. Inexperience and human carelessness are still the two worst culprits. The sooner they are apprehended, the quicker will be our recovery to safety records of former years.

How much of our trouble is due to the new man on the job? Or to the former employee returning to work after a year or so of enforced idleness? There can be no doubt that each is a factor. In Great Britain, where business recovery is perhaps further advanced than here, there have been similar increases in industrial accidents. These the Chief Inspector of Factories attributes largely to the fact that many new workmen, suffering from lack of nourishment, are physically and mentally less alert and therefore more liable to mishaps. His evidence also shows that after long periods of unemployment, some workers overexert themselves in their efforts to make good. This sort of nervousness is especially noticeable, he reports, among young technical men given their first jobs after several years of anxious waiting. What is to be done about it?

In one American chemical plant, a sponsorship plan of safety education has recently been introduced with gratifying results. New and inexperienced employees or former employees, who have been out of work so long that their

safety habits have become rusty through disuse, are given not only the usual instructions from their foremen, but each man is turned over to some older, more experienced employee, who agrees to serve as "his brother's keeper" during this breaking-in period. It is surprising how promptly and effectively the system is working out. The new man gets the benefit of individual instruction from the fellow with whom he stands shoulder to shoulder in his daily work. In turn, the instructor unconsciously becomes a more careful worker when he accepts the responsibilities to serve as a model for his less experienced brother. There may be nothing very novel about the sponsorship plan, but it does help to place additional emphasis on the training of the new employee.

Another large chemical company is attempting to stem the rising tide of accidents by carefully studying the safety records of every individual employee. Men who have had or have been the cause of three or more injuries are being shifted to less hazardous work. Furthermore no recruit is re-enlisted in this particular industrial army if his service record shows too many wound stripes.

Some of the rise in accidents is undoubtedly due to relaxation on the part of the management. If this be true in your company, then it will pay someone to make certain that there is a general tightening up in safety work from the very top to the bottom of the organization. Workers must understand that management believes in safety, backs safety and is determined to have safety at any cost. Then only will the worker adopt safety as a natural and habitual part of his conduct. The Safety Congress in Cleveland early next month will be a good place to turn for new inspiration and sense of direction in this important work.

EDITORIALS

This Must Not Spread

TEXTILES and chemicals are so interdependent that we have much more than a sympathetic interest in the outcome of the industrial warfare from which our sister industry is suffering so severely. A textile strike not only cuts off the market for many chemicals, but it actually threatens the security of operations in several lines of closely related activity, such as the manufacture of rayon and dyes and those bleaching and finishing processes conducted in chemical plants. If the conflagration spreads to chemical industry, the strikers will have to answer for something more than their own welfare. Health and safety of the general public are so much involved in most chemical industries that a nation-wide chemical strike would likely prove in effect a strike against the public itself. The utter futility of such a course should be self-evident to even the blindest of labor leaders.

An Open Season For Chemical Tariffs

TRADE agreements being negotiated by the State Department with other governments virtually open all chemical tariffs for consideration if not for actual readjustment. This is a dire sounding statement, but the threat is not in fact so great as one might think. Nevertheless there is a threat, and one which must be given thoughtful study by every chemical executive.

The Cuban treaty recently announced is not a fair sample of the negotiations to come. In the first place, it was a treaty; remaining negotiations will lead to trade agreements. In the second place, the methods of negotiation first followed have proved impractical, and now even greater secrecy of study within the State Department is contemplated. In the third place, and perhaps most important, when new tariff agreements are reached for other nations they will apply to all nations alike. Only in the case of Cuba may the United States disregard its many existing commercial treaties which ensure "most favored nation" treatment to practically all important powers. Cuban rates can be, actually are, different and special.

The Secretary of State from time to time is announcing that he is negotiating an agreement with a certain nation. At the same time it is expected that he will announce a list of the principal commodities dealt with between the United States and that nation. This, in effect, merely shows that any commodity of consequence in the trade of the United States will be subject to scrutiny, if not actual tariff adjustment, when these agreements are under study.

Under these circumstances, it is obviously unnecessary to wait for the State Department to make any further pronouncements about commodities. Each chemical executive must assume that his type of commodity is under consideration, if in any part of the United States foreign trade it is an item of consequence. And the developments may go even farther than that. The Administration may actually seek to

make some commodities not now important in our trade a basis for new international barter.

Alarmist reactions are not warranted or desirable, but vigilance is. Active and aggressive representation through trade associations appropriate for each commodity is essential. And, too, time is of the essence.

Slaked Lime, Hydrate of Confusion

SLAKED LIME is chemically not so irregular, but physically it is uncertainty personified. And its usefulness varies tremendously with the physical properties which it possesses. Many chemical engineers know this, to their sorrow.

Something should be done about this matter. We are convinced that only thorough technical research, with the collaboration of a goodly number of practical lime users, is going to improve the situation. We believe such research and such cooperation will be forthcoming. It certainly should be. Both producers and users would be benefited thereby.

It is now proposed that National Lime Association take the lead in this matter with the aid of such scientific and educational institutions as are able to assist. For the benefit of the Association, *Chem. & Met.* would like to have comments and criticisms from lime users. Particularly we should like to know what main difficulties are experienced in the selection, the slaking, and the use of lime. We should like to know how some of these difficulties have been solved. We should like to know the unsolved problems that still plague chemical industry. Even confidential information can be used in furthering the cause without any violation of confidence.

It is hoped that many readers will feel disposed to aid in this matter. The importance of lime today, and its greater potential importance tomorrow, fully justify every effort which all may give to an advancement of the knowledge of commercial calcium hydrate.

Intercommodity Effects Recognized by N.R.A.

DESTRUCTIVE price competition existing in the alcohol industry may be further curtailed by code amendments adopted in late August. Open price filing is provided for under the new sections of the supplemental alcohol code, a division of the Chemical Manufacturing Industry. This is a forward step toward stability in an industry that has far too often been shaken by unfair trade practice.

One further step must, however, be taken to consolidate this advance. The price filing requirements of the alcohol code do not take effect until like provisions are made for methanol from the hardwood distillation industry. At that time exchange of price filings will begin, and the proper restraining influence of open prices be established for both alcohols.

This is a clear recognition by N.R.A. authorities that

not only for anti-freeze but also for its solvent uses, little brother methyl can disturb sister ethyl unduly if he misbehaves in the price-cutting field. It is fortunate that official recognition has been given to this fact, which has long been known by chemical engineers and in the trade.

Saying It With Dollars

MR. FORD has said it with Dollars. Twelve million five hundred thousand dollars is the announced extent of Mr. Ford's project for steel mills and power plants to serve his Detroit properties.

Since there is, from all accounts, plenty of steel making and power making capacity lying idle in this country of ours, Mr. Ford's project is worth reflection. Did Mr. Ford figure to make a profit? Doubtless some profit, and doubtless some additional advantages from better control over the source of his principal raw material, steel, were in the back of his mind; but we suspect also that in this same shrewd mind the dread specter of inflation loomed pretty large.

We recall a recent conversation between an American chemical engineer and a German executive, who was showing our friend through one of the great plants of the I.G. Marveling at the tremendous size of the works, the American asked about its approximate cost. The German shrugged his shoulders as he replied, "Ich weiss nicht! You may name your own figure. It was built during inflation with depreciated marks, when payments in script were sometimes worthless before the contracts were completed." Exaggerated, perhaps, but what happened in Germany in 1924 is not a very comforting prospect for those with idle American money in 1934.

Now if those of us with these surplus Dollars should fear that inflation is coming, and forthwith set about to exchange Dollars for durable goods and such "fixed" wealth, just what would be the result? The immediate result would be a tremendous increase in payment of wages, in the activity of construction, transportation, and the heavy industries. Business would be "good." The properties thus created would be more efficient than those now existing and incidentally we would doubtless get the price increases (or better the profit margins) so much desired without resorting to monetary inflation.

Looking further to the future, would there be over-capacity for the production of goods? Mathematically, yes. But remember that depression or no depression, five years is a long time and the world has moved ahead considerably since 1929. Japan, for example, with a present industrial production index of 139.8 per cent of 1928, Great Britain with 103.3 per cent, or even Germany with 88.5, compared to our 77.5, are all evidence that we are getting behind in the tide of world affairs. And we cannot expect to meet world competition with obsolete plants and antiquated machinery, even though we have plenty of gold.

The fact that in five years Washington has not "solved" our problem should mean something. Wash-

ington can't. Washington has become like a circus (in fact, is a circus in many respects, with clowns, roaring lions, agile monkeys and whip-cracking ringmasters.) Just about all the nation are spectators, and when the circus is in town, not much work is done in mills, in offices and in households.

We are not inflationary, we are not socialistic, and we are not inclined to experiment with the welfare and property of 100,000,000 and more people. We are just old-fashioned, old-fashioned enough to believe that if we don't unloose those Dollars like Mr. Ford is doing, those Dollars will unloose themselves on us, and we will have all the things we don't want with nothing to show for our money. It's time the circus folded up. Let's say it with Dollars!

Further Processing For Calcium Acetate

CHEMICAL industry finds the purchase and use of acetic acid generally more convenient than the starting of operations with calcium acetate. This is a definite handicap on the wood chemical producer. Only one measure of escape from this problem seems open—the substitution of acetic acid for calcium acetate.

Such a substitution is easy to suggest but difficult to accomplish. There remain only a few wood distillation plants large enough to justify direct recovery of acetic acid that do not already have facilities for that purpose. It is evident, therefore, that the next step in organization will be the pooling of acetate production by companies in this industry, either regionally or nationally, for the conversion to acetic acid.

Such cooperative enterprise should not be difficult to organize. It is quite analogous to the cooperative effort already being so successfully carried out with respect to methanol refining. Such an advance is logical. It seems, indeed, almost inevitable.

Sane Power Plans For Bonneville

COOPERATION between state, public utility, and federal authorities interested in power development on the Columbia River is most fortunately evident. Chemical industry will look on the project there with greater interest because demagogery is being laid aside and a sound business basis sought.

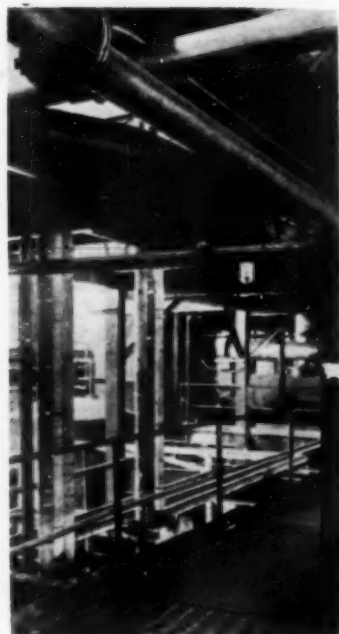
The Bonneville Commission, an agency of the state of Oregon, is in charge of the studies which will, it is hoped, lead to the establishment of a new power-using enterprise at this strategic point only a few miles up river from the Portland, Oregon, deep-sea harbor.

No one can yet foresee just what power will cost there, nor what will be the advantages, or perhaps disadvantages, of this interesting industrial site. However, it is a location which must not be overlooked by any who have interest in cheap power, marketing in the Far Northwest, or desire for Western development with an eye to Trans-Pacific trade.

Developments in Processing of RESINOUS WOOD WASTE

By R. C. PALMER

Chief Chemist
Newport Industries, Pensacola, Fla.

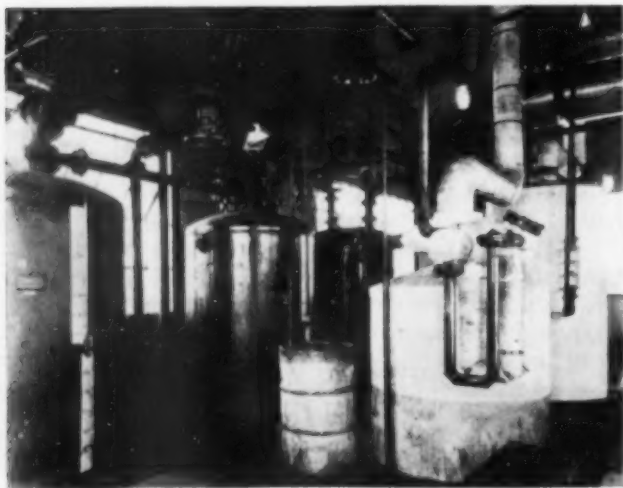


A GENERAL DESCRIPTION of the steam and solvent process for recovering turpentine and rosin and products such as pine oil from stumps and other cut-over pine land waste was published in this magazine several years ago (*Chem. & Met.* Vol. 37, p. 289, 1930).

A distinction may properly be drawn between the terms "producing" and "processing" as applied to the turpentine and rosin or naval stores industry. Turpentine and rosin are "produced" by the living pine tree in the form of a gum or oleoresin. One needs only to collect the free flowing gum from the living tree and separate it into its components by a simple distillation, an operation so simple that the opportunities to manufacture modified or special products to meet the changing needs of user industries or to seek new markets are quite limited.

In the steam and solvent industry the conditions are

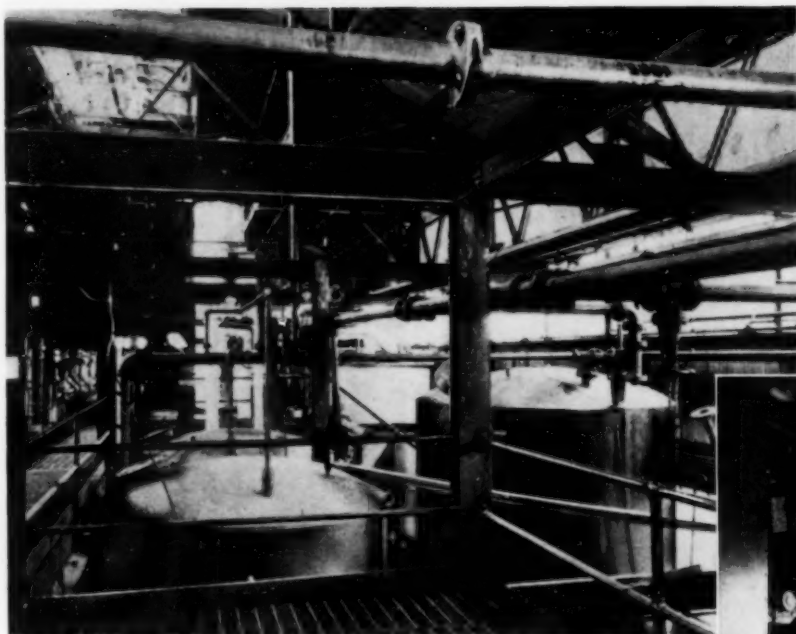
Oil fractionating building showing tops of fractionating columns and receivers



different. Although the primary products, turpentine and rosin, have here also been produced by the original living tree, the oleoresin will no longer flow from the wood of the stumps or limbs. Other materials have also been produced, and as far as the recovery of pure primary products is concerned these secondary materials may be considered as impurities which greatly increase the difficulties of making high-quality products.

Many of these difficult processing problems have been successfully solved. Turpentine and rosin now obtained from resinous wood waste are in every way equal in quality with the purest materials obtained from the living tree. Valuable products are also manufactured from what were essentially impurities, and a number of both primary and secondary products are given additional chemical treatment to impart new properties for special uses. Finally a new industry has been developed to utilize the wood waste from which the oils and resins have been extracted.

The entire oily constituent of virgin gum oleoresin is composed of 90 to 95 per cent alpha and beta pinene. This is a pure material for thinner for paints and varnishes and for solvent in waxy shoe polishes which are the principal industrial uses. A listing of the compounds contained in the oily material present in a long leaf pine stump reads like part of the index of a treatise on essential oils. In the order of their relative boiling points there have been found present besides pinene, also camphene, para menthene, limonene, dipentene, cineol, alpha terpinene, terpinolene, fenchol, borneol, "menthanols," alpha and beta terpineol, terpinenols, and the phenol ethers, methyl chavicol, and anethol. There is every reason to believe there are other terpenes still unidentified. Some of these are rarely found in nature, but have heretofore been seen only as products of laboratory synthesis. It seems probable that the starting material for all these materials is alpha pinene and the chem-



Rosin purification plant showing equipment used in preparing rosin solution before filtration, and also evaporators. Below is seen an 8-shelf dryer



istry involved is chiefly hydration, oxidation, and isomerization.

In the early development of the steam and solvent naval stores industry this large number of terpenes was roughly grouped into two commercial products, steam distilled wood turpentine and steam distilled pine oil. There was much overlapping of one group with the other because of incomplete knowledge and inefficient equipment. It might be supposed that a considerable number of these terpenes have only been identified by laboratory methods, but such is not the case. A large number are now available either quite pure or as the principal constituent of commercial raw materials.

The crude oils obtained by steam distillation of the resinous wood also contained real impurities not of a terpene nature. It was early found that simple but thorough chemical treatment with alkali removed these materials. Fractionation in specially designed columns serves as one means of separation, but as terpene hydrocarbons are often destroyed by polymerization on heating vacuum fractionation is essential. One of the developments of the producers of steam distilled turpentine has been to supply the recently perfected synthetic camphor industry with large quantities of alpha pinene.

In recent years the petroleum solvents with about the same boiling range as turpentine have been freely used as substitutes for turpentine in thinning paints and natural resin varnishes, at one time an almost exclusive turpentine market. There is, however, a noticeable swing back to terpenes as solvents for protective coatings, particularly for those of the lacquer and synthetic resin type. It is interesting to note that the terpene hydrocarbons considered impurities in steam-distilled turpentine, and which were at one time responsible for much of the sales resistance toward the turpentine, are taking the lead in this development. Dipentene is the principal component of these hydrocarbons, although limonene and terpinene which have equivalent proper-

ties are also present, and this group is now a standard product of the steam and solvent naval stores industry and is sold as commercial dipentene. It is an excellent solvent for many of the synthetic resins, prevents gelation or "skinning," improves the gloss and flow of the film and possesses other desirable properties. The definite advantage of the presence in turpentine of these hydrocarbons which have a slightly higher boiling point than pinene is now also apparent for a number of types of paints, enamels, and varnishes.

Some of the terpene constituents of resinous wood cannot be recovered in pure form by fractional distillation. This is particularly true of the secondary alcohols, fenchol and borneol, and the phenol ether methyl chavicol. Alpha terpineol can be concentrated by fractionation and separated commercially pure by crystallization, but the yield is rather low. Chemical treatment involving hydration of tertiary alcohols to solid hydrates followed by fractionation and subsequent chemical dehydration and refractionation is necessary to obtain near quantitative yields of borneol and fenchol. Upon oxidation these secondary alcohols are converted into their corresponding ketones, camphor and fenchone. Methyl chavicol is readily isomerized to anethol by heat and alkali.

The production of alpha terpinene in high concentration has resulted in another recent development. This terpene is unique in having two conjugated double bonds which make possible the formation of new synthetic resins by condensation reactions.

The proportion of dipentene hydrocarbons probably does not exceed 10 per cent of the total oil in resinous

wood. The tertiary alcohols comprise roughly one third of the total and these can be processed in a number of ways to split off water and yield dipentene hydrocarbons, thus increasing the potential supply if desired.

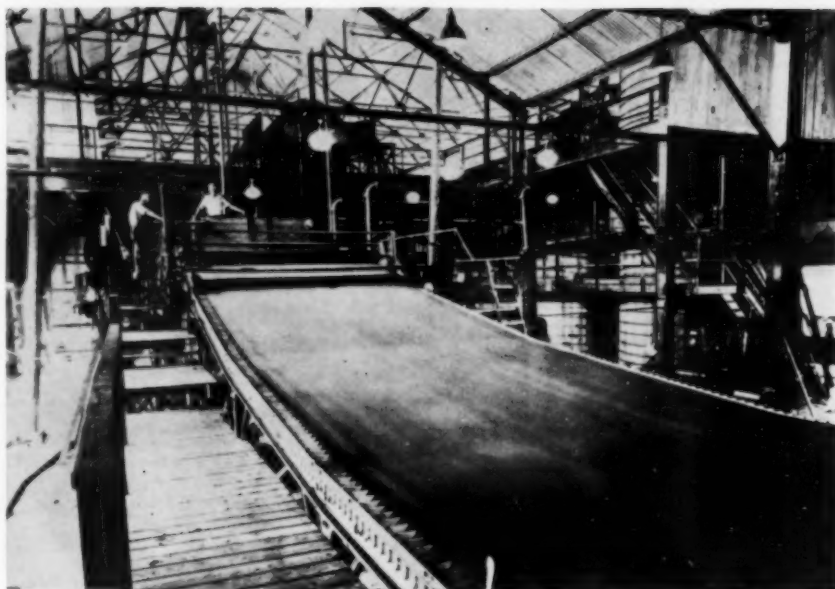
Much more could be said of the developments relating to the oil products. All that have been mentioned are either semi-commercial or fully developed process steps in steam and solvent naval stores plants today.

The wood rosin extracted from pine wood waste grades FF or between E and F on the gum rosin scale has a distinguishing reddish color by transmitted light. Its chemical properties are unlike the corresponding grade of gum rosin in several particulars, and even greater differences are shown when compared with the paler grades of gum rosins. These characteristics relate to melting point, acidity, ester value, and unsaponifiable content, the kind and quantity of pigments present, and even isomeric forms of abietic acid.

The peculiarities of natural wood rosin prohibited its use in many of the usual rosin markets. However, for some purposes these qualities were unimportant and in others proved an actual advantage, so a considerable volume of ordinary wood rosin has been consumed in a variety of industries for a number of years. As long as 12 yr. ago wood rosin producers began manufacturing the FF grade modified with lime to increase the melting point. A few years later heat treatment was introduced to effect partial isomerization of the abietic acid which increased the solubility and avoided objectionable crystallization characteristics (W. B. Logan, U. S. Patent No. 1,643,276).

Shortly afterwards it was discovered that the introduction of water-soluble alkali salts of rosin acids in the course of manufacture improved the rosin for several special purposes (R. C. Palmer, U. S. P. 1,787,281). More recently the melting point has been greatly increased by following the heat isomerization with partial vacuum distillation at very low pressures in specially designed equipment. (R. C. Palmer and A. F. Oliver, U. S. P. 1,881,907). These treatments overcame many objections and helped considerably to broaden the markets. Wood rosin was, however, still largely barred from some of the largest standard consuming industries, such as the protective coating field, laundry soap, and white paper size because of its color or pigment content, to say nothing of possible new uses which might result if light colored wood rosins could be manufactured.

The removal of the color of natural wood rosin was a stubborn problem and its final successful solution is probably the most important recent development in the industry in relation to its future possibilities. A fundamental fact never lost sight of by those interested in the future of the steam and solvent naval stores industry is that the solid resin or rosin recovered from the pine stump is the bulk product amounting to roughly four and one-half times the oil obtained, and that rosin



Board coming from forming machine. Background shows part of first and second floor of pulping building

as such is by far the cheapest organic acid raw material available.

There are two quite different processes in use for removing the color of wood rosin. One process based on the decolorizing action of fullers earth was developed by Newport Industries, Inc. It has been known for some years that the dark colored components of wood rosin are selectively absorbed by fullers earth. These impurities are apparently oxygenated and hydroxylated resin acids and esters of resin acids as well as decarboxylated acids. FF wood rosin contains a considerable proportion of these materials, roughly 25 per cent in terms of conversion from FF to water white (WW) grade. A pound of fullers earth costs about 40 per cent of the value of rosin in recent years, but it requires about two and one-half pounds of earth to remove the pigment from a pound of rosin. In its simplest application, therefore, the raw material alone would make the cost of the purified rosin double the natural extracted rosin. The adaptation of this medium to wood rosin purification to make a workable process was then obviously dependent on making the earth do its maximum amount of work in any single operation and, of even more importance, on being able to reuse the earth a considerable number of times.

Decolorizing Rosin

In the present plant the rosin to be decolorized is dissolved in petroleum naphtha free from terpenes (R. C. Palmer, T. L. Burda, A. F. Oliver, U. S. P. 1,807,599) at around 15 per cent concentration and the rosin solution percolated cold through a series of filters containing a 16 to 30 mesh earth arranged in a cycle system (Palmer, Burda, Oliver, U.S.P. 1,905,493). Fresh dry earth first completely absorbs the entire rosin content of the solution, but as the earth continues to contact more solution, the purified rosin is released and the absorbed material becomes more and more only the



Temlok board coming from the dryer. Sheets may be sawed into desired sizes, sanded, beveled and laminated

impurities because the earth apparently has a greater capacity to retain oxygenated and hydroxylated materials. The volume of rosin solution filtered constitutes the entire precontrol of the quality or grade of pale rosin desired since the FF rosin is remarkably uniform. A filter is left in the decolorizing cycle until the earth is completely saturated with only impurities.

Revivifying Decolorizing Agent

After displacing the rosin solution in the saturated filter it is washed with hot petroleum naphtha containing about 35 per cent by volume of anhydrous ethyl alcohol (Palmer, U. S. P. 1,794,537). This revivification solvent rapidly dissolves the impurities from the earth and after washing out the alcohol-naphtha extract with naphtha until all alcohol is removed the filter is again ready to take its place in the rosin purification cycle. This operation can be repeated almost indefinitely and the life of the earth is so great that its cost is practically negligible.

Iron is noted for its coloring effect on rosin. After the decolorized rosin solution leaves the earth filter it comes in contact with only aluminum or aluminum alloys until the finished liquid rosin is delivered to galvanized shipping containers. By special treatment it has been possible to produce pale wood rosins for special industries with an iron content guaranteed below 0.001 per cent (Oliver and Palmer, U. S. P. 1,881,893).

The alcohol naphtha revivification solvent is recovered for reuse with exceptionally high efficiency in fractionating columns employing a closed vapor system.

All of the impurities removed in the decolorizing process are recovered as a dark resin. This material is unique in chemical properties and except for a few purposes cannot be fully substituted for rosin. It has, however, found a number of uses based on its distinguishing characteristics.

Through the cooperation of the technical division of

the General Naval Stores Co., the sales subsidiary of Newport Industries, Inc., it was found that a number of the modifying treatments previously given FF rosin are readily applicable to the pale grades, including heat isomerization of the resin acids (Logan, U.S.P. 1,807,483), followed by partial vacuum distillation if desired (Palmer and Oliver, U.S.P. 1,881,907) and partial neutralization with the common water soluble alkalis or with lime, all to better effect for special purposes than when applied to the FF wood rosin.

Petroleum solvent solutions of rosin neutralized with four or more per cent of hydrated lime called "gloss oils" have a large use in the paint and varnish industry. The manufacture of these products is easily accomplished in certain steps in the process of producing wood rosin. The production of large volumes of different types of gloss oils of very pale color and exceptional clarity and uniform-

ity of other desired qualities has been one of the developments resulting from the purification of wood rosin.

In addition to the removal of color bodies the processing of wood rosin has also produced changes in the chemical properties. For example, the acidity and melting point have been notably increased. Wood rosin after purification can now be used as raw material for the manufacture of many new products, such as the various esters of rosin acids and as modifying agents for a number of synthetic resins. The production of hydrogenated rosin and the recovery of commercially pure abietic acids in different isomeric forms are also possible and are in the early stages of development.

Since the inception of the steam and solvent naval stores industry the resinous wood from which the oils and rosin have been largely extracted has been commonly used as fuel to produce the steam and power requirements for the plant operation. Much thought and research was expended in an effort to produce satisfactory kraft pulp or paper from this material but without success in regard to quality, compared to the accepted standards for this type of pulp and paper.

Several years ago the Armstrong Cork Co. conducted an extensive investigation of a great variety of raw materials in the search for definite characteristics suitable for a low cost fibrous insulating and building material. This study resulted in the selection of the extracted pine stump wood as having the most desirable combination of properties. The Armstrong-Newport Co. was then organized and a plant with a daily capacity of about 100,000 sq. ft. of 1 in. material was constructed at Pensacola in conjunction with the naval stores plant of Newport Industries. This commercial unit consumes only about one third of the available supply of extracted wood. The product is sold by the Armstrong Cork and Insulation Co. under the trade name Temlok.

The process used is partly chemical and partly mechanical (D. F. Smith, E. J. Pieper, C. C. Vogt, U. S. P. 1,873,056). The extracted wood chips are first

screened to separate dust or sand and then run through a rod mill in the presence of hot caustic alkali water solution. This treatment breaks down the wood into a coarse pulp while the action of the caustic is to saturate the fiber and soften it. The alkaline water also partially extracts the rosin left in the wood and neutralizes wood acids and removes easily water-soluble lignin decomposition products. The latter action was found to be of great importance in producing a fiber having the exceptional water resisting qualities desired.

The rod mills are horizontal cylinders about 6 ft. in diameter and 12 ft. long and contain about 20 tons of 3-in. diameter steel rods. Fibration takes place as the cylinder is rotated and the chipped wood comes between the heavy rods sliding and tumbling upon each other. It takes but a few minutes for the material to pass through this machine.

This pulp, still in the presence of the hot alkali solution, is then given a second chemical and mechanical fibration in a disk-type Bauer mill which completes the pulping action. A certain degree of hydration of the fiber is desired which is begun in the rod mill and continued in the disk mill.

Concentration of the finished pulp and removal of the bulk of the water alkali extract is the next operation and this is accomplished by collecting the pulp on a rotating wire drum or Decker.

The pulp is then diluted with water to the desired consistency and alum added to a controlled pH value to size the fiber. The quantity, character, and internal distribution of the soap materials which react with the aluminum sulphate together with other binding agents present in and on the fiber accounts for the excellent water proofness of the final product and also partly explains its strength in proportion to weight.

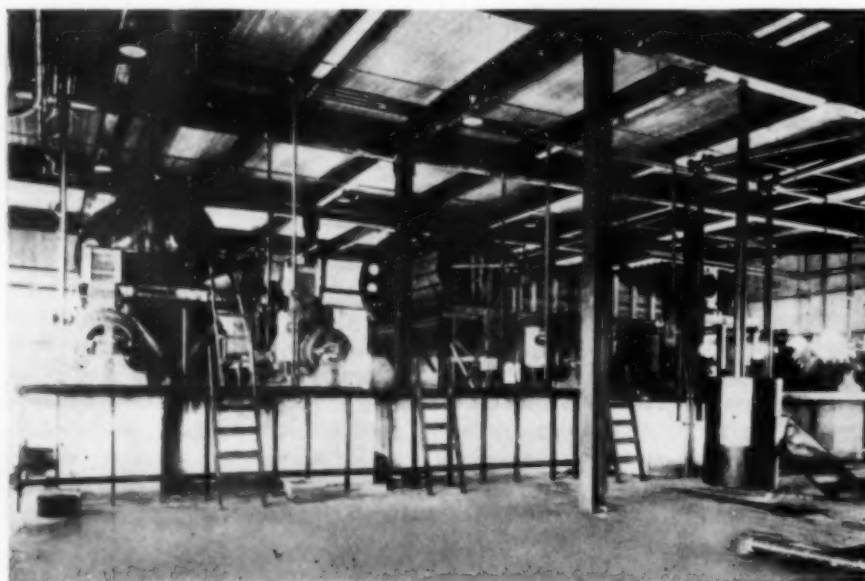
A continuous sheet of pulp about 12 ft. wide is then formed on what is essentially an Oliver filter. The density or concentration of fiber in the water fed continuously to the vat in which the filter rotates controls

the thickness. The top surface is smoothed and the sheet is lightly pressed between felts under a five-roll Downingtown press. It is automatically cut into desired lengths while still wet and passed into a temperature-controlled Coe shelf dryer.

The density, strength, and thickness of the sheet of Temlok is varied through quite a range to meet different requirements. Sheets varying in thickness from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. thick and weighing 0.85 to 1.7 lb. per sq. ft. per in. thickness are regularly produced. Strength is sometimes added to the product by mixing 10 to 15 per cent long fibered kraft pulp to the stock before fabrication. The moisture resistance is shown by the fact that the maximum water absorption from the air is less than 10 per cent and it will not disintegrate if immersed in water. The product is of a very porous structure and has, therefore, high insulation value against heat or cold. The conductivity of Temlok roof insulation is 0.32 B.t.u. per sq. ft. per in. thickness per deg. F. per hr., at average air temperature.

After the sheets come from the dryer they are sawed into desired sizes and may be also handled in many other ways similarly to wood, such as sanding, beveling, and laminating. Temlok is produced for a large number of uses such as roof insulation, refrigeration insulation, wall finishing, sheathing, plaster base, acoustical, and decorative tiles and many others. Its natural color is the characteristic golden brown of the pine and it is frequently used for interior finishes, but can also be given many types of coating for decorative purposes or to impart fire resistance.

It has been long recognized that the products of the pine tree native to the southern section of the United States had great potential possibilities as a basis for an important chemical industry. This brief review of some of the recent chemical and engineering developments in the processing of resinous wood waste indicates the progress that has been made in the realization of such an industry.



Pulping building showing rod mills and Bauer mills. A certain degree of hydration of the fiber is desired which is begun in the rod mill and continued in the disk mill

New Developments in Pulp and Paper

EDITORIAL STAFF REPORT

FOR THE FIRST TIME in the history of the organization the Technical Association of the Pulp and Paper Industry held its fall meeting on the Pacific Coast. The selection of Portland, Ore., for the meeting was a success as proved by the record-breaking attendance. Much of this success was due to the convention chairman, H. R. Heuer of Longview, Wash., and his committee.

The technical program included many interesting papers. The first of these was an account of the history and biography of the industry by Ralph M. Snell of the Hurlbut Paper Co. and B. T. McBain, consulting engineer of Portland.

The second contribution to the program concerned the pulping of Douglas fir in ammonia bisulphite solutions. A series of experimental cooks in ammonia base liquor were made with a mixture of commercial spruce and hemlock chips, with old Douglas fir chips, with young Douglas fir chips, and with Douglas fir chips which had been previously treated with a five per cent solution of ammonia at a temperature below 70 deg. C., by H. K. Benson and his associates at the University of Washington, Seattle.

In evaluating these experimental pulps it was found that young Douglas fir closely parallels the commercial spruce and hemlock; that pre-treated Douglas fir approaches spruce and hemlock; and that pulps made of old Douglas fir are of a distinctly lower order of quality.

Zinc Sulphide Pigments

Increasing the usefulness of less expensive paper fiber by the use of zinc sulphide pigments was the subject of a paper by F. A. Steele, of the research division of the New Jersey Zinc Co. These pigments, as fillers, were shown to be advantageously adapted to use in paper and boards made with less expensive fibers and are not confined to use in the fine paper field.

The design, application and safety features of cubicle type motor control for squirrel cage, synchronous and wound rotor motors were discussed in a paper presented by E. H. Vicary, engineer representing several Pacific Coast pulp and paper mills, and K. L. Howe of the Westinghouse Electric & Manufacturing Co. The authors conclude from a review of the important features, combined with flexibility of construction, that cubicle type motor control units are worthy of consideration for new mill projects and rehabilitation of existing plants.

Power possibilities in the Northwest were discussed by C. C. Hockley, state engineer for Oregon, Public Works Administration, Portland. The West Coast has one-third of the potential water power of the entire country, which has 40,000,000 hp., of which 12,000,000 is developed.

The effect of pH upon the absorption of dyes by

cellulose and fillers was the subject of a paper by Leo Friedman and D. V. Kuykendall, Jr., Oregon State Agricultural College. The authors reported the results of their studies of the absorption of acid and basic dyes upon alumina, cellulose and paper fillers. The results demonstrated the important part played by the freshly precipitated alumina and the necessity for careful control of the pH. Investigation of the absorption of methylene blue upon cellulose kaolin, and talc showed that the process is true absorption since it follows the Freundlich absorption law.

In a paper entitled "Consistency Regulation," Frederick Wierk, of Johnson and Wierk, Inc., reviewed the principles relating to paper stock consistency regulation and the various types of regulators. In closing his remarks he stated that it is felt that if the principles of consistency regulation are fairly well understood there should be very little difficulty in the selection and installation of a device which will satisfactorily maintain desired stock conditions.

Absorption in Sulphite Tower

The theory of absorption applied to the sulphite tower was discussed by W. L. Beuschlein and Frank H. Conrad of the department of chemical engineering at the University of Washington. Huge quantities of sulphur dioxide are absorbed annually in the limestone packed towers; and while the technical design and operation of these towers have been perfected to the degree of standardization, little has been written previously concerning the factors affecting the sulphite tower operation and especially the rôle played by the several fluid films which control the rate of sulphur dioxide absorption.

Recent years have witnessed many improvements in the machinery and processes used in the pulp and paper industry. Electricity has for many years been an important factor in the economical manufacture of paper, and the article by R. V. Maier of the General Electric Co. summarizes the apparatus as developed by his company applicable to the industry.

Charles S. Keevil, professor of chemical engineering at Oregon State Agricultural College, presented a review of the principles of heat transfer together with illustrations of their applications to pulp and paper mill heat transfer equipment. However, the drying of the product is an important step, not only as it affects the quality but also the cost of manufacture, and drying involves the transfer of large quantities of heat. The cooling of the gases from the sulphur burners, prior to absorption, is a heat transfer problem; and the evaporation of waste liquors, for purposes of recovery or disposal, is another application.

Among the other contributions to the technical program were: the pulp wood of Oregon and Washington; technical control in pulp and paper manufacture; pulpwood supply of the Pacific Northwest; the system $\text{Ca O-SO}_2\text{-H}_2\text{O}$; design and operation of hog fuel burning and handling equipment; "the 14" steam line between the Washington Gas and Electric Co. and the Longview Fibre Co.; the Texas Gulf Sulphur Co., spray type sulphur burner; the casting problems of stainless steels; pulp specifications; maintenance and the technical man; and Metalayer operation as applied to the pulp and paper industry.



By WEBSTER N. JONES

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What Are the Trends in ENGINEERING EDUCATION?

As head of process engineering for the B. F. Goodrich Co. "Web" Jones distinguished himself not only by his chemical engineering ability but also by his knowledge of men. He was sought as an advisor, both by young men entering his company's employ and by the executives concerned with the building of a sound technical organization. His intensely human

interests naturally attracted him to educational work, which he entered in July, 1932. Since then he has had an unusual opportunity to view from within the workings of our whole system of training engineers. His views, first presented last Spring before his former associates in the Akron Rubber Group, are worthy of thought by all within the profession.—EDITOR.

ENGINEERING is many years behind the medical profession in regard to educational requirements. One might even venture to say that the physician is more highly respected than the engineer. This is not entirely due to the greater length of time spent in college. Curing of human illnesses has a personal appeal with which engineering achievements cannot compete. Engineers work collectively to achieve great technical results; physicians give individual attention to their patients. Their code of ethics is rigidly respected. By concerted action, they have determined the educational program for the profession.

Classification of medical schools sounded the death knell of many poorly-equipped and inferior-staffed institutions. The engineering societies have just begun to interest themselves cooperatively in the education and training of prospective engineers. The first annual report of the Engineers' Council for Professional Development appeared only last December. (See *Chem. & Met.*, Jan, 1934, pp. 16-17). Able committees have been selected to cope with the following questions: Student selection and guidance; professional training; engineering schools; and professional recognition. Careful study of these will have an important influence on engineering education.

Getting Off to the Right Start

All chemical engineers are concerned with their own professional advancement, and a goodly number are now giving thought to the problem of seeing that their sons select professions in which they will be vitally interested and in which there is the most promise for service and achievement. The Education Research Committee of the Engineering Foundation has issued a pamphlet, "Engineering, a Career, a Culture," as a message to young men, to parents, and to teachers. It covers in a very readable manner the activities of civil, electrical, mechanical, mining, metallurgical, and chemical engineers.

Many engineering colleges give a one-hour lecture course for freshmen to acquaint them with the various

engineering fields in order to assist them in the choice of a profession. Clement C. Williams, Dean of the College of Engineering of the University of Iowa, has just written an interesting book on "Building an Engineering Career." (McGraw-Hill, 1934). The American Association of Engineering, with J. A. L. Waddell as Chairman of the Editorial Committee, has issued a book on "Vocational Guidance in Engineering Lines," (Mack, 1933). These books give evidence of the added interest that engineers are taking in educational matters.

Engineering schools are noted for the quantity of work required of their students. Curricula have not been influenced by the teachings of President Eliot of Harvard with regard to freedom in the selection of courses. It is safe to say that engineering colleges require at least 20 per cent more work of their students than is demanded by liberal arts schools. Secretary of Agriculture Wallace addressing engineers at the American Association for the Advancement of Science meeting in Boston, made this statement:

In the engineering courses of the future, the engineers should be given an opportunity to enrich their minds with the imaginative, non-mathematical studies, such as philosophy, literature, metaphysics, drama, and poetry. Of course, so long as an engineer is burdened with the necessity of putting in 18 hours a day mastering calculus, mechanics, and the complex theories of electricity, he simply cannot give any effective attention to the cultural aspects of life. And if by accident an engineer, exposed to studies of this sort, should be enthused by them, he might for the time being become somewhat less effective as an engineer. We are thus exposed to a dilemma, which I would be tempted to solve by saying that probably no great harm would be done if a certain amount of technical efficiency in engineering were traded for a somewhat broader base in general culture.

At Carnegie Institute of Technology, students are required to do 54 hours of school work per week. We are vitally concerned with the quantity of work required of freshmen in an engineering school. The atmosphere of a college is entirely different from that of a high school. High school graduates who made A's soon have the con-

ceit taken out of them when they receive their first marks in chemistry and mathematics. They do not realize the full significance of the term "work." In adjusting themselves to their new environment, they should not be thrown into the stream before they have learned to swim. Last year the freshman load at Carnegie Institute of Technology was reduced, and this year more freshmen were on the honor roll than ever before.

Each one of us has, no doubt, formulated an opinion on what is essential in engineering curricula. A graduate of three years stepped into my office and I asked him the question, "What change would you propose in the curriculum outlined for your course in engineering." The reply was that more emphasis should be placed on applied subjects. He had had a taste of industry and felt the lack of practical experience. A graduate of 15 years was asked the same question. His answer was that more English, public speaking, and economics should be embodied in the curriculum. He had recently made his initial appearance before a board of directors and had had difficulty in selling his ideas. The same question was asked of a graduate of 25 years and his reply was that the curriculum should contain more music, art, drama, and philosophy. He was a general manager of a steel mill, had mastered the industrial processes of steel making, was able to sell his ideas to his superiors, and had reached the age at which he would like to enjoy a more abundant life.

The criticism that engineering curricula are overloaded with technical subjects, could be answered by the plan of extending the years of study. Columbia University was the pioneer in this educational movement. California Institute of Technology has recently adopted a five-year plan "based on recognition of the fact that a four-year period of study is inadequate to give satisfactorily the combination of cultural, basic scientific, and engineering studies essential to the highest type of engineering, and to afford at the same time leisure for the development of the physical well-being and human interests of the students."

Engineering colleges have awakened to the necessity of fostering graduate study. The rubber companies, especially, pride themselves in their effective research laboratories of physics and chemistry, manned with scientists who have spent several years in graduate study before being selected for their positions. Many graduate schools are equipped and staffed to train graduate physicists and chemists for industrial research. Perhaps the engineering colleges have been remiss in not actively fostering graduate work.

Carnegie Institute of Technology feels compelled to enlarge its opportunities for graduate students because eventually the study of engineering will probably become a graduate course. We have excellent research men on our faculty to direct the efforts of graduate students into the unknown fields and enjoy the heartiest cooperation of the industries of the district which give freely of time and money for the promotion of research.

Humanizing Engineering

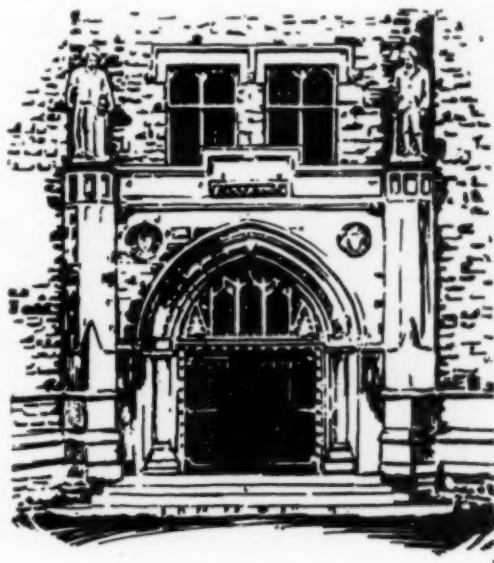
In days gone by, industry attracted many teachers "from the college halls to the factory walls." Recently, there has been a tendency for colleges to call engineers with industrial experience into educational work. Last year the important position of Head of the Department

of Mechanical Engineering at the Massachusetts Institute of Technology was accepted by J. C. Hunsaker, formerly a vice-president of the Goodyear Zeppelin Corporation. Three years ago Robert E. Doherty was selected as Head of the Department of Electrical Engineering at Yale University, and recently he was appointed Dean of Engineering. Mr. Doherty was formerly consulting engineer of the General Electric Company and was responsible for the selection and training of technical men.

Massachusetts Institute of Technology and Yale University have instituted courses in Human Engineering. The M.I.T. course was the outgrowth of a series of lectures dealing with human and professional relationships. It was first handled by Colonel Charles R. Gow, who has recently published a very interesting and instructive book on "Fundamentals of Human Engineering."

Toward This Ultimate Goal

In conclusion, I wish to summarize the distinctive trends in engineering education. Much thought is being given to selection and guidance of prospective engineering students. There is a decided tendency toward the extension of the teaching of basic and cultural subjects to prepare graduates to meet ever-changing economic conditions. Engineering colleges are realizing the fundamental importance of research, especially for students with a decided bent toward creative work. The human side of engineering is being stressed and will lead to greater life enrichment. Teachers of engineering are aware of their grave responsibility in encouraging young men to search diligently for knowledge and wisdom and in stimulating them to aspire for a higher order of citizenship. The ultimate goal of engineering colleges is to produce men of superior qualifications, especially initiative, creative instinct, breadth of vision, and capacity for hard work; men who possess *physical fitness* to enable them to carry on energetically, *tenacity of purpose* to compel them to stick to the end, *resourcefulness* to direct them out of the beaten path into unexplored regions, *personality* to enable them to live amicably in their environment, and *knowledge* in their particular fields to render them capable of creative work.



Heat and Power Balance in Chemical Plants

IN GENERAL, the question of heat and power balance concerns the possibility of coordinating the generation of steam for power and process so that the power needed is obtainable as a byproduct of the process steam demand.

The first step in attempting to balance these loads should be a careful survey, involving accurate measurements, of the heat and power required by the various processes. In this connection, care should be taken in studying the process use of low-temperature heat as obtainable from process steam.

Bearing in mind that the terminal pressure required at the power turbine exhaust or bleed point is a direct function of the required process pressure plus distribution loss, one should see to it that such terminal exhaust or bleed point pressure is as low as practicable, in order to provide the maximum practicable expansion range within the power turbine before secondary utilization of the steam as heat. Oftentimes an intelligent study of the application of steam for process use not only results in increased byproduct power but in improved industrial products as well.

Inasmuch as superheat normally retards the rate of heat transfer in process use, the temperature of steam at the power turbine exhaust or bleed point should normally be such that the superheat is sufficient to overcome transmission losses and yet deliver only slightly superheated steam at the point of application. This procedure results not only in full process recovery of the latent heat of condensation (by far the largest percentage of heat energy in the steam), but further enables the turbine blade elements to rotate in a superheated atmosphere, thereby contributing to long life and freedom from erosion.

Choice of Electrical Characteristics

The choice of electrical characteristics demands an analysis of the following factors: (1) individual motor application; (2) power factor of individual motor application, assuming a.c. motor drive; (3) problem of electrical transmission and distribution; and (4) generation requirements as may be dictated by manufacturers' standards.

The application of individual motors has an important bearing on the resultant overall electrical power factor and this, in turn, on the reduction of electrical transmission losses and the required kilovolt-amperes of generating capacity. The intelligent application of synchronous motors to constant torque applications will normally result in an overall plant power factor close to unity.

The problem of electrical transmission and distribution chiefly concerns the matter of voltage or electric pressure as applied both to individual motors and at the point of distribution from the power generating unit. Where the area of transmission is appreciable or subject

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to extension with plant growth, the investment both in motors, transmission and distribution equipment can be greatly reduced by choosing the highest voltage consistent with safety and operative control. Except for small motors under 20 hp., this will normally result in the choice of 2,200-v. motors and 2,400-v. generators for the moderate sized plant.

Turbine and Steam Plant

The heat-power ratio, as determined from the heat-power survey is, of course, the dominating factor in the choice of power turbine characteristics. The economic objective is now that of generating the steam at sufficiently high pressure and temperature that it may be expanded through turbines to reduce from boiler to process pressure, converting as much as possible of the heat energy made available by this expansion into power and yet maintaining terminal pressure and temperature conditions at the exhaust or bleed point of the power turbine consistent with the requirements of process.

Preliminary choice of turbine characteristics may now be made by study of source material such as C. B. Campbell's article "Byproduct Power From Steam Turbines" appearing in the September, 1927, issue of this magazine.

The selection of boiler pressure, as well as the temperature of steam to apply at the outlet of the boiler superheater, are matters most often improperly coordinated in the industrial plant. In the first place, the pressure and temperature loss between boiler and turbine throttle must be constructively analyzed in order that the requisite operating steam pressure and temperature may be available at the turbine throttle. As the steam density increases with pressure, this factor assumes greater importance.

Byproduct power turbines may be located in a centralized turbine room forming the distribution point for power and process steam, or they may be located directly at the point of power use. It is significant to note, however, that in some of the late power stations the partition between turbine and boiler rooms has been eliminated, both to minimize line drop and reduce capital expenditure.

The next consideration is that of operative boiler drum pressure in relation to safety valve settings. The modern 450-lb. boiler may have as many as six drum safety valves in addition to the safety valve provided at the outlet of the boiler superheater. The greater the number of valves,

Obviously the operating drum pressure must be so chosen that variations in plant steam load can normally be compensated for without popping safety valves. If the control of combustion is manual and the plant steam demand variable, the differential between operating drum pressure and the lifting pressure of the first safety valve must be in the order of 20 to 30 lb. on a 450-lb. boiler. The provision of automatic combustion control might reduce this by 50 per cent, depending on the method of firing. Again, the question of pressure drop through the boiler superheater may be of great significance in determining the available pressure at the turbine throttle.

Irregularities in steam plant operation are most commonly caused by irregularities in heat input to furnaces, irregularities in feed water input to boilers and irregularities in steam output from boilers, such as may be caused by the erratic popping of safety valves, slagging or fouling of the outer surface of boiler and furnace tubes, scaling or blistering of the inner tube surfaces, scaling or fouling of economizer and air heater tubes, failure of ash handling equipment, and various other accessory troubles.

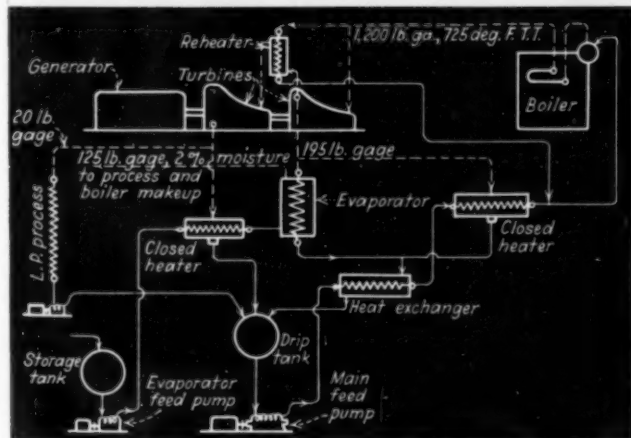
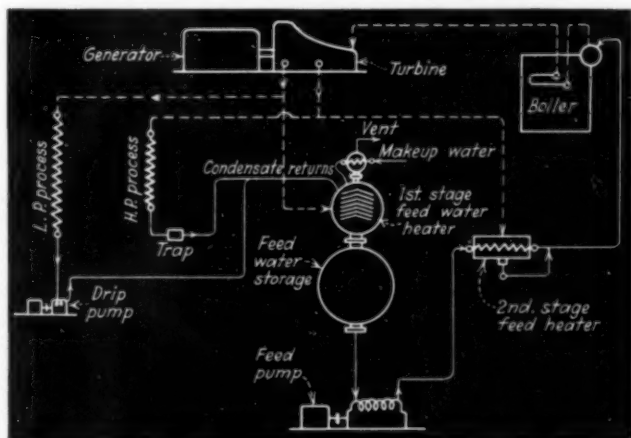
Scaling and blistering of drums and tube surfaces are inexcusable today on boilers up to and including the 600-lb. range, granted a constructive analysis of the character of feed water, definite knowledge as to the quantity of boiler makeup (*i.e.*, unreturned condensate), and the provision of a suitable continuous blow-down system to permit reliable control of the boiler water concentration and chemical content. For boiler pressures above 650-lb. gage, it will generally prove expedient to evaporate all makeup feed water.

With the provision of insurance against normal irregularities in heat input to furnaces as above outlined, the provision of automatic control of combustion should be capitalized in those plants operating on a continuous 24-hour schedule, six days per week, at a relatively high load factor.

It is important that the steam delivered to the power turbines be free from entrained solids to insure freedom from turbine blade erosion and troubles incident to fouling of the turbine blade passages. In the normal boiler, steam leaves the saturated drum at approximately 2 per cent moisture, such moisture carrying with it its component part of the solids present in the boiler water. These solids in turn dry out in the boiler superheater, thereafter being carried forward into the power turbines and transmission system. Through recent methods of baffling and washing within the boiler drum, it is now possible practically to eliminate the entry of entrained solids into the boiler superheater, thereby insuring the delivery of clean steam to the power turbines.

Fig. 1—Regenerative feed heating in two stages (non-condensing bleeder-type turbine)

Fig. 2—Regenerative feed heating in two stages with local, one-stage, reheating with live steam



steam require the removal of the heat equivalent of generated power before delivery to process, it follows that, in the event of turbine outage, provision must be made for the automatic supply of live steam to process, the temperature and pressure of which have been automatically reduced to the requirements of the process through suitable pressure-reducing and desuperheating equipment. The most common method of desuperheating is based on the vaporization of a portion of the boiler feedwater through suitable spray injection and control devices.

Although it is highly important that the pressure-reducing and desuperheating equipment be properly designed for the desired range of steam flow, it is essential that reducing valves of this character be arranged for isolation and operation through manual bypass in the event of operating trouble.

The question of auxiliary drive is of vital importance in the steam plant, particularly the use of spare steam drive to maintain continuity of operation of essential auxiliaries in the event of failure of electric power for any reason. In most cases, however, the heat balance should be predicated on efficient electric drives with provision for spare steam-driven boiler feed, fan or other auxiliaries, designed to cut in automatically in the event of electric power failure.

In striving toward a "best" heat utilization cycle, the problem of heating the boiler feed assumes first impor-

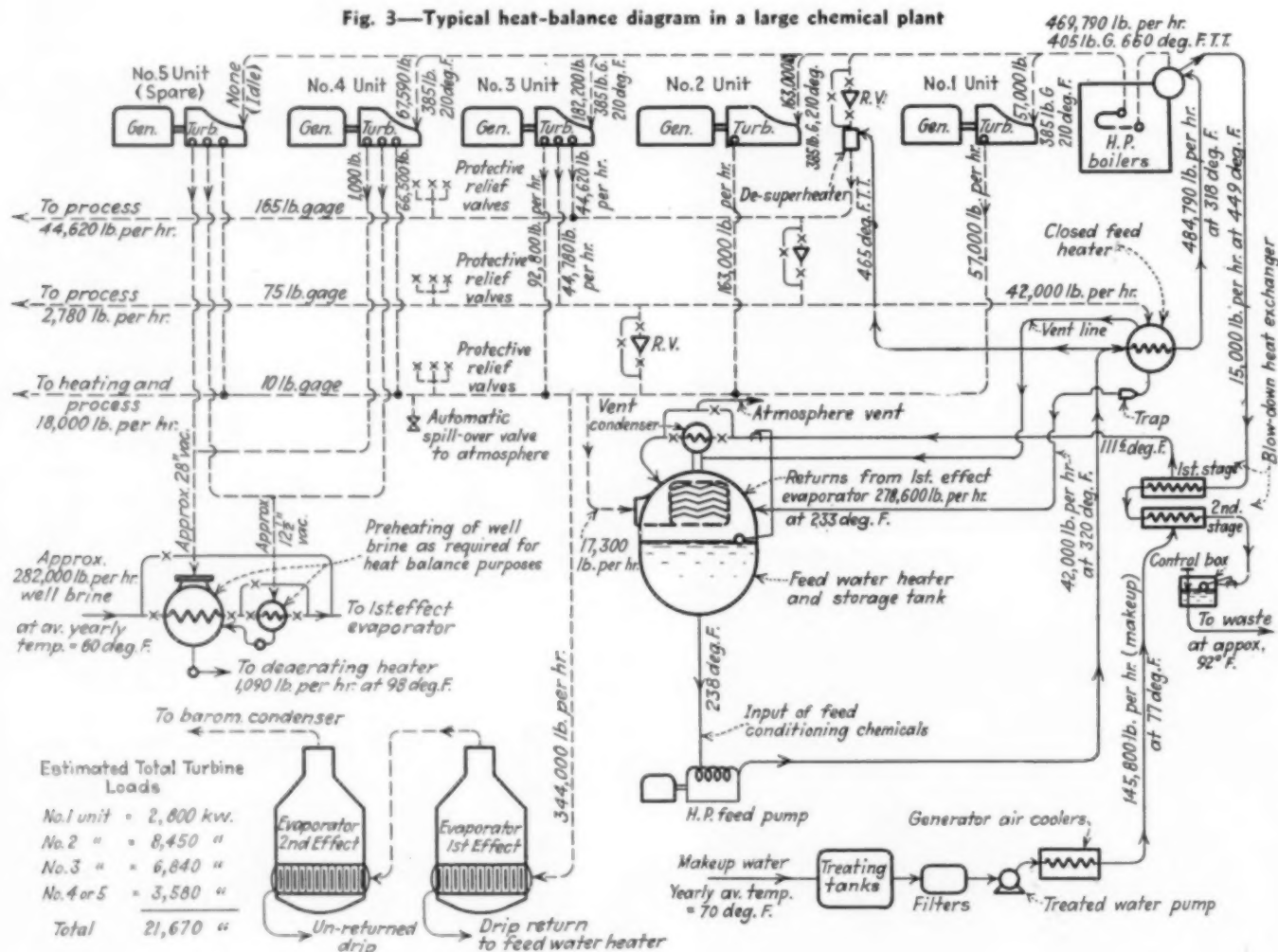
tance. Where a large proportion of the required power is developed as a byproduct of the process steam and where the initial steam conditions are such that the steam may be expanded to process pressures without encountering moisture in the turbine exhaust, the simple, regenerative, feed-heating cycle will be used, the number of stages depending on the range of process pressure, station size, load factor, etc. Where the initial operating conditions are such as to produce moisture at the point of delivery to process (as, for example, expansion from 1,200 lb. gage, 725 deg. F. to 20 lb. gage exhaust) it will be necessary to resort to reheat between turbine stages and, further, to evaporate all feed makeup in order to secure satisfactory boiler operation.

Heat Balance Considerations

Typical line diagrams of regenerative feed heating in two stages, and of regenerative feed heating in two stages with local reheat by live steam in one stage, are shown in Figs. 1 and 2. Heat balance calculations, together with an analysis of the heat flow diagram determine the final choice of the operative cycle. Typical heat-balance and heat-flow diagrams are shown in Figs. 3 and 4.

The operative cycle of Fig. 3 employs two-stage regenerative feed heating, and the heat-power ratio is such that all power can be generated as a byproduct of the process. Of particular interest is the preheating of well

Fig. 3—Typical heat-balance diagram in a large chemical plant



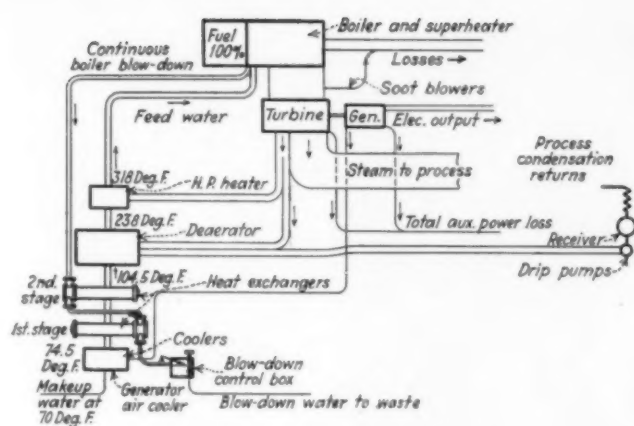


Fig. 4—Typical heat-flow diagram

brine for heat-balance purposes, the expansion of the power steam being carried to 12½ in. and 28 in. Hg vacuum as required for two stages of process heating.

In this case, turbine units Nos. 1, 2, and 3, are assumed to be operated under "pressure control" in accordance with the demands for process steam, while units Nos. 4 and 5 operate "load governing" for the maintenance of frequency and power balance.

The provision of heat storage, as through a steam accumulator, is often justified as a means of eliminating fluctuation of boiler demand with resultant improved boiler operating efficiency. Such cases require process demand at two or more pressures, permitting "energy charge" at the higher pressure and "energy release" at the lower pressure. Definite knowledge of steam demand is essential to the success of such applications.

In the practical working out of heat balances, various types of turbine control must be resorted to. In this connection turbine manufacturers have been keen to anticipate the needs of industry and today turbines may be purchased for different types of control such as "pressure control" at one or two points, "temperature control," "frequency control" and "load control." These various forms of control are fully outlined in an article by S. H. Hemenway, entitled "Turbines to Fit the Plant," appearing in the April, 1933, issue of this magazine. In any case, the adjustment of turbine characteristics should be worked out in cooperation with the turbine manufacturer.

In most cases, the industrial plant is justified in generating that portion of power which it can obtain as a byproduct of process, the balance of power required to be generated or purchased from an electric service station, depending on the economics of the particular case. In these situations, the consideration of spare generating capacity is directly associated with the cost and availability of purchased power for standby and demand service.

Analysis of Operating Performance

Of first importance in the analysis of operating performance is the development of a general plan of metering, to show diagrammatically the location of all recording steam and water meters essential to the obtainment of a daily operative balance between the steam generation and the steam distribution. In so far as possible, it is im-

portant that master meters be installed as a check, both on the sum of group individual meters and for departmental analysis. For reduction to standard conditions steam measurement demands not only the flow reading as obtained from the meter nozzle or orifice, but also the temperature and pressure at each point of flow measurement.

With daily readings for operative control, it is assumed that daily, weekly and periodic reports will form the basis for analysis of operating performance.

Where the latent heat of the power steam can be used in the process, the heat charge per kilowatt-hour generated can only be that of the heat equivalent of a kilowatt-hour (3,411.5 B.t.u.), plus the radiation and mechanical losses in the turbine and copper, iron, windage and excitation losses in the generator. All of these losses will not normally bring the total heat loss in the turbine per net kilowatt-hour delivered above 3,800 B.t.u. and the equivalent heat consumption, including boiler and auxiliary losses, will not be in excess of 5,000 B.t.u. (station rate).

Where a portion of the heat in the power steam is rejected to a steam condenser, the heat rate (measured at the turbine throttle) is, of course, materially increased, dependent on the component of heat rejected. The heat rate (measured at the turbine throttle) for straight condensing units is dependent on the initial operating steam conditions, the size and character of the turbine unit and the number of stages of regenerative feed heating. The following performances are indicative of good operative practice:

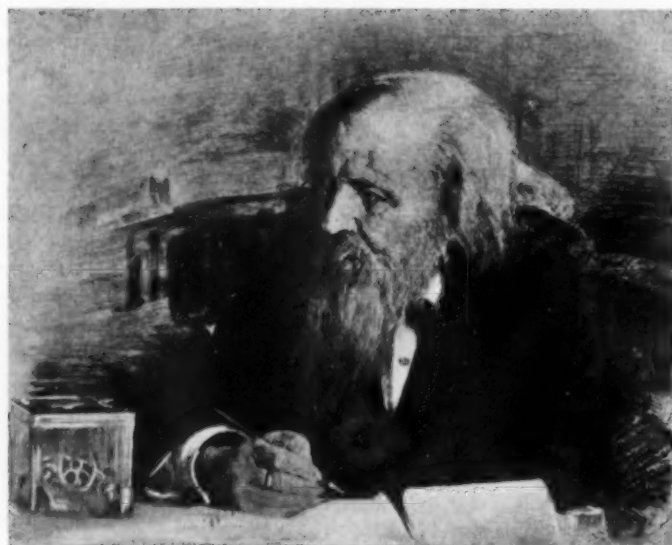
Operating Steam Conditions	Turbine Size	Throttle Heat Rate, B.t.u. per Kw.-Hr.
250 lb. gage, 100 deg. F. supht., 28 in. Hg vac.	3,000 kw.	14,950
400 lb. gage, 200 deg. F. supht., 28 in. Hg vac.	6,000 kw.	13,400

Station rates for byproduct power heat consumption may now be directly compared with the following station rates for direct power generation:

Plant	Exhaust Temp., Deg. F.	Station Rate, B.t.u. per Kw.-Hr.
High pressure central station (condensing)	80	12,000
Mercury-steam plant	80	10,000
Diesel engine plant	700	10,000
Diesel steam plant	80	8,000

Modern industrial cost accounting practice requires the analysis of operating costs from cost sheet data applying both to the main steam and power services. Such cost sheets should be issued daily, weekly and periodically, (i.e., by division of the year into 13 equal periods) as required for executive analysis of operating costs. The steam plant becomes the supplier of steam and power services to the several departments of the industrial plant, the operating costs of which are separately viewed by the general manager.

These cost sheets further make possible a comparison of actual expense with budget items; any differences are made to stand out quickly and are subject to frequent conference to determine causes, and, if necessary, to adjust budget standards from month to month. Thus the influence of load factor becomes apparent in the cost analysis, demonstrating a fact well known to power plant designers, namely, that a knowledge of probable actual load factor, to be used as the basis of design, is one of the most important factors to be considered in any extension or new construction.



Dmitri Ivanowitch Mendeleeff, 1834-1907

MENDELEJEFF CENTENARY

By E. SWIATLOWSKY

Director Mendeleeff Centrogaphical Laboratory, Leningrad

CONVENING in Leningrad in September of this year the Seventh Mendeleeff Congress on Chemistry takes on particular signification in view of the fact that this year marks the hundredth anniversary of the birth of this greatest of all Russian scientists, and one of the most prominent chemists of all time. For this reason the Congress will be international in its character, with delegates from a number of foreign universities and scientific institutions.

Dmitri Ivanowitch Mendeleeff was born in Tobolsk, Siberia, on Feb. 8, 1834, the youngest child of a large family. When his father, the principal of the high school of that city, was stricken with blindness, the care of the family fell upon the wife, Maria Mendeleeff, who then took upon herself the management of a glass plant and paper factory founded by her family in Tobolsk. Dmitri, her favorite child, showed early signs of exceptional gifts in mathematics and the natural sciences, and before his mother passed on she had the satisfaction of seeing him enrolled as a student at Central Pedagogic Institute in Leningrad, from which he graduated with honors. After brief studies in Heidelberg and Paris he was appointed professor of chemistry at the Institute of Technology in Leningrad, and a few years later he was made professor at the University of Leningrad, a position he held to his death in 1907.

To the scientific world Mendeleeff will always be identified by his greatest work, the discovery of the

periodic system of the elements which he first gave to the world in his paper to the Russian Chemical Society, "Relation of the Properties to the Atomic Weights of the Elements." The principle here set forth has become one of the fundamental concepts of modern chemistry, and recognition came almost instantaneously.

Curiously enough Mendeleeff was not elected to the Russian Academy of Sciences, but a large number of chemical and scientific societies, in Russia as well as abroad, conferred their highest honors upon him. He was given the Davy Medal and held the unique distinction of receiving a doctor's degree both from Oxford and from Cambridge. The list of his scientific titles, as was jokingly stated by his friends, was much longer than the list of titles held by the Czar. He was also one of the first foreign honorary members of American Chemical Society; at the Century of Progress Exposition of Chicago the periodic table was given a prominent position in the Hall of Science.

Arrangements for the celebration of the Congress have been made by a special committee of the Academy of Sciences of U.S.S.R., headed by N. S. Kurnakoff, director of the Institute of Physical Chemistry in Leningrad. The Academy is furthermore instituting annual lectures on important achievements in the field of chemistry, physics, and mathematics, to be held on February 8, the birthday of Mendeleeff, and commemorative prizes have been established. An All-Union Mendeleeff

Society was also formed this year, in Moscow. And plans have been made for the erection of a monument on the Vasilievsky Island in Leningrad, on the square between the University and the Academy of Sciences.

Publication of the selected works of Mendelejeff has been undertaken by the Academy of Sciences, ten volumes, each 400-500 pages, being scheduled for appearance during 1934-36, with the following content: (1) The periodic system of the elements. (2) First scientific works. (3) Investigation of aqueous solutions by specific gravity. (4) Solutions. (5) Gases; meteorology; resistance of fluids; aerostation; metrology. (6) Chemical engineering (oil, coal, fuel, iron, explosives, and other subjects); agriculture. (7-8) Social, economical, and industrial problems. (9) Principles of Chemistry. (10) Critical and biographical outline; bibliographies; indexes.

Mendelejeff himself states that much painstaking labor, great patience, and minute attention to detail have been required in these investigations. "To four subjects," he continues, "I owe my name: The periodic law, the investigation of expansion of gases, the conception of solutions as associations, and my Principles of Chemistry. Here is all my wealth."

"Evidently the periodic law is not threatened with destruction in the future, and only superstruction and development are to be expected. Until now very little has been said about the expansion of gases, although 30 yr. have elapsed. In this respect I rely upon the future. I hope that it will be understood that all I have discovered is of universal nature and is of great importance for the understanding of Cosmos and of the infinitesimal. This, I believe, is gradually being appreciated. Here I have only a little of the factual, but solid principles have been clearly presented; here I must rely principally on the Americans who have begun to introduce much of value into chemistry. They will remember me in due course, as they evidently study chemistry from the viewpoints presented in my Principles of Chemistry. Evidently the new English editions are printed for them. This book is my favorite child. It bears my image, my experience as a teacher, and my innermost thoughts."

Translations Prove Value of Writings

For comparison it is interesting to note the following statements in the preface to Eighth Edition of "Principles": "The unexpected and rapid success with which the concepts of the periodic dependence of the elements upon the atomic weights have spread in our science, or rather, the perseverance with which in this work I have gathered the most important facts about the elements and their mutual relations, explain why the former editions have been translated into English, German, and French.

"The fact that the translation into English was published in three editions struck me most forcibly. The appearance of the first edition I could explain as a desire of English chemists to know the periodic system of the elements from the primary source. But with the appearance of the two next editions, the second in 1897, and particularly the third, in 1905, it became evident that English and American students use this book. I confess that I had not dared to expect this, and it touched my Russian heart."

From the study of purely theoretical problems Mendelejeff proceeded to the questions of applied chemistry and physics, and then to industrial and technical problems. The breadth of his scientific interest surprises everyone who studies his works. "All outstanding and unusual in Nature irresistibly attracted Mendelejeff's thoughts," D. P. Konovalow said in his eulogy, "the eclipse of the sun, the polar ice, the origin of petroleum, and finally, the ether in space. Longing to penetrate the mysteries of Nature he was never afraid of long and arduous work. With the same undivided attention he studied the expansion of gases and fluids and the shift in the center of the population of the great Russian state."

Work Still Continued

In fact, a number of questions which attracted Mendelejeff are foremost in the thoughts of Soviet scientists at the present time, as for instance underground gasification of coal; deep drilling; direct extraction of iron from ore; aerostation and aviation; the conquest of the Arctic; the route to the Far East across the North Pole; the changing level of the Sea of Azov; the shift of the center of population toward the south-east; organization of public feeding; extension of education; participation of woman in industry and administration; the Central Statistical Board. He was extremely interested in the determination of geographical centers of a country made by the U. S. Bureau of Census. In its westward movement the center of population of the United States has clung to the 39th parallel of latitude in a remarkable manner. The same movement toward the Pacific Ocean—the great world stage of the future—Mendelejeff observed for Russia. "The center of population of Russia is shifting," he wrote in 1905, "and it is possible to state with assurance that it will advance toward the blessed South and East with their abundance of fertile soil." This prophesy has been confirmed. In 1926 the center of population had passed beyond the Volga to the vicinity of Marxstadt. Thus was initiated the so-called "centrography," the systematical development of which took place only short time ago, mainly as a result of Italian and Soviet schools. From the very beginning many important contributions in this field have also been made by American Scientists.

The most interesting memorial to this great scientist, the Mendelejeff Museum at the Institute of Standards and Measures, was founded in Leningrad in 1928, in the very room in which the discoverer of the periodic system of the elements worked during the last 15 yr. of his life. In the collections are included the printed works, manuscripts, notebooks, photographs, and, most important of all, the apparatus and instruments with which many of his most important researches were carried out. A short description of this museum was published in the Soviet *Weekly News Bulletin*, No. 39-40, 1929). Since that time it has been greatly enlarged, and the number of instruments and other relics has increased. The important work of collecting this valuable material has been done by the director, M. Mladentzeff, assisted by Mendelejeff's friends and associates, particularly the late president of the Chamber of Weights and Measures, D. Konovalow, the death mask of whom has now been given a place in the museum beside that of Mendelejeff.

Rational Method of Selecting Screw Conveyors

By R. F. BERGMANN

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SCREW CONVEYORS, because of their flexibility of application, low first cost, economy and ease of operation, are being used to an increasingly great extent in the handling of a wide variety of process-plant materials, of which those substances enumerated in Table I are typical. With suitable modifications in design, such conveyors are capable of operating, not only horizontally and at small inclinations, but also at any angle up to the vertical. However, most screw conveyor applications are horizontal and what is said in the earlier sections of this article relates only to horizontal conveyors. In a concluding section there is discussed the effect that increasing angles of operation have on the design, power consumption

and capacity of screw conveyors for higher elevation.

Although within certain limits practically any powdery or granular material, as well as certain pasty materials, can be handled in screw conveyors, the characteristics of the material have a decided bearing on certain of the factors of design and operation. These include the depth of loading, the rotational speed of the screw, the clearance of the screw and the type of bearings and shaft couplings to employ. It is the purpose of this article to present data, much of it new, making possible the determination of the factors, together with the permissible lump size and the power consumption.

The first consideration in the choice of a conveyor sys-

Table I—Average Weights of Materials With Capacity Classifications, Bearing and Coupling Recommendations and Horsepower Factors

(These recommendations apply to horizontal conveyors of standard design used under ordinary conditions of service.)

Material	Weight Per Cu. Ft., Lb. *	Capacity Classifi- cation	Recom- mended Hanger Bearings and Couplings †	Horse- power Factor, "F" ‡	Material	Weight Per Cu. Ft., Lb. *	Capacity Classifi- cation	Recom- mended Hanger Bearings and Couplings †	Horse- power Factor "F" ‡
Alum, lumpy.....	50-60	III	Ba ¹	1.4	Lead oxides.....	30-150 ⁴	IV	WI	1.0
Alum, pulverized.....	45-50	II	Ba ¹	0.6	Lime, ground (unslaked).....	60	III	Ba ²	0.6
Bakelite and similar plastics.....	30-40	IV	Wd	1.4	Lime, hydrated.....	35-45	II	Ba ²	0.8
Baking powder.....	50-55	II	Wd	0.6	Lime, hydrated, pulverized and air separated.....	32-40	I	Ba ²	0.6
Bauxite, crushed, dry.....	75-85	IV	WI	1.8	Lime, pebbles.....	56	IV	Ba ²	1.3
Bones, crushed.....	35-40	IV	WI	2.0	Limestone dust.....	75-85	IV	WI	1.6
Bone black.....	20-25	IV	WI	1.7	Limestone screenings.....	85-90	IV	WI	2.0
Bone meal.....	55-60	IV	WI	1.7	Linseed cake, pea size.....	48-50	II	Ba	0.6
Borax.....	50-55	III	Ba	0.7	Linseed meal.....	44	I	Ba	0.4
Calcine flour.....	75-85	IV	Ba	0.7	Lithopone.....	45-50	IV	Wd	1.0
Carbon black in bulk.....	4-6	III	LB	0.4	Mica, flake.....	17-22	III	WI	1.4
Cement, portland.....	75-85	IV	WI	1.4	Ore, zinc, flotation.....	65-80 ⁴	IV	WI	1.7
Chalk, crushed.....	85-90	IV	WI	1.9	Paper pulp stock, 4% or less.....	62	III	Wd	0.9
Chalk, pulverized.....	70-75	IV	WI	1.4	Paper pulp stock, 6 to 15%.....	60-62	IV	Wd	1.2
Charcoal.....	18-28 ⁴	III	Ba	1.4	Paraffine cake, broken.....	45	IV	Ba	0.6
Clay, brick or tile, dry, ground.....	100-120	IV	WI	2.0	Phosphate, acid, pulverized, 6 to 8% moisture.....	60	IV	WI	1.4
Coal, fines or slack.....	40-45	II	Ba	0.9	Phosphate, granular.....	90	IV	WI	1.6
Coal, pulverized.....	32-35	I	Ba	0.6	Salt, coarse.....	45-51	III	Ba ²	1.2
Coal, sized.....	45-50	III	Ba	1.0	Salt, dry fines.....	70-80	III	Ba ²	1.0
Cork, ground.....	12	III	Ba	0.5	Sand, dry.....	90-110	IV	WI	2.0
Cottonseed, dry.....	25	III ³	Ba	0.9	Shale, crushed.....	85-90	IV	WI	2.0
Cottonseed cake, cracked.....	40-45	III	Ba	1.0	Slate, crushed.....	80-90	IV	WI	2.0
Cottonseed meal.....	35-40	I	Ba	0.4	Soap, powdered.....	20-25	III	Ba	0.9
Cottonseed meats, dry.....	45-50	II	Ba	0.6	Soda ash, dense.....	55-65	III	WI	0.7
Cottonseed meats, rolled.....	35-40	II	Ba	0.6	Soda ash, light.....	20-35 ⁴	III	WI	0.7
Dolomite.....	75-90	IV	WI	2.0	Sugar, raw.....	55-65	IV	Ba	1.0
Feldspar, ground.....	65-70	IV	WI	2.0	Sugar, refined.....	50-55	III	Wd	0.7
Flaxseed.....	45	I	Ba	0.4	Sugar beet pulp, dry.....	12-15	III	Ba	0.9
Flaxseed, meal.....	25	I	Ba	0.4	Sugar beet pulp, wet.....	25-45 ⁴	III	Ba	0.9
Fluorspar.....	110	IV	WI	2.0	Sulphur, lumpy.....	80-85	IV	Ba	0.8
Fullers earth, raw.....	35-40	IV	WI	2.0	Sulphur powdered.....	50-60	IV	Ba	0.7
Fullers earth, spent, 35% oil.....	60-65	IV	WI	2.0	Tanbark, ground.....	55	III	Ba	0.7
Gelatin, granulated.....	32	II	Wd	0.8	Tankage.....	60-62	III	Ba	0.6
Graphite, flake.....	40	II	Ba	0.4	White lead.....	35-55 ⁴	IV	WI	1.0
Graphite, flour.....	28	II	Ba	0.4	Zinc oxide.....	10-35 ⁴	IV	Wd	1.0
Gypsum, calcined.....	55-60	III	WI	1.2					
Gypsum, crushed.....	90-100	IV	WI	1.6					

*Weights are for materials when slightly agitated or fluffed, as when handled by screw conveyors.

†Symbols for hanger bearings and couplings.

Ba—Babbitted bearings, grease lubricated, and cold-rolled steel couplings. Bronze bearings, grease lubricated, may also be used.

I.B—Self-lubricating bronze bearings and cold rolled steel couplings.

Wd—Hard maple or lignum vitae bearings, oil or paraffine impregnated (self-lubricating). Cold-rolled steel couplings.

WI—White iron bearings (usually non-lubricated), with hardened steel

couplings. Stellite bushings, or hardened steel bearings may also be used. Manganese steel couplings sometimes employed.

¹Where contamination of the product must be avoided, use Wd.

²Conveyors handling cottonseed may be operated at speeds of 60 to 75 per cent over the maximum recommended by the curve of Fig. 6.

³Some operators prefer WI.

⁴The wide variations in weight are due to grade or conditions of material as produced for specific commercial purposes, or to moisture content.

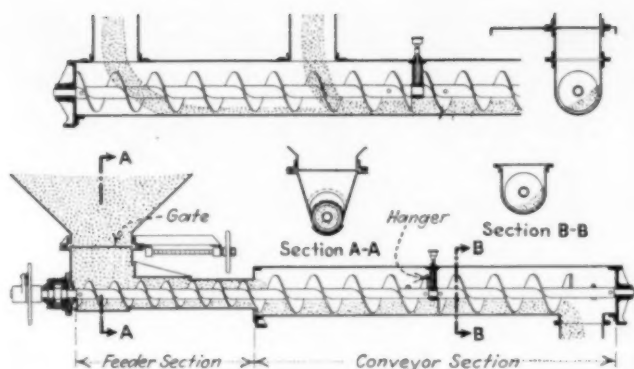


Fig. 1—Above: Typical screw conveyor fed through chutes

Fig. 2—Below: Feed screw used to control feed rate to conveyor

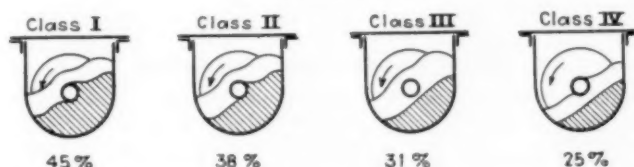


Fig. 3—Typical loading cross sections for materials as classified in Table I

tem is the methods of feeding. These include: (1) methods in which the feed rate is controlled by some means outside the conveyor proper, such as a continuous-feed machine discharging to the conveyor (*e.g.*, pulverizer, mixer, screen, etc.), or an intermittently-feeding rotary valve or a gate; and (2) methods in which a portion of the screw operates as a feeder. Figure 1 shows a feed of the first type in which streams enter through one or more chutes or spouts, dropping into the trough of an ordinary run of conveyor. The second method, illustrated in Fig. 2, operates under a "head" of material, using as a feeder a smaller screw on the same shaft and completely submerged in the material. This method performs satisfactorily except with extremely fluid or fluffy, aerated materials which would tend to "spiral" through the trough

in intermittent rushes and cause flooding. A feeder of this type is installed in a tubular housing without hangers in the feeder section. Its size, in relation to the main screw is chosen so that its delivery when operating full will be just sufficient to be handled properly by the main conveyor.

How full a conveyor may be loaded depends on the character of the material. All of the materials listed in Table I have been divided into four classifications, each of which is adapted for a certain loading of the screw. The cross-section diagrams of Fig. 3 illustrate these four typical loadings. The shaded portion represents the average level of material in the trough. The upper line shows the approximate maximum height of material at the carrying side of the flights when the average loading is maintained. The percentages represent average percentages of cross section in material, while the class numbers are those referred to in the third column of Table I.

Light and free-flowing materials, weighing up to 30 or 40 lb. per cubic foot, such as pulverized coal and air-separated hydrated lime are assigned to Class I. Class II materials include medium weight, non-abrasive, granular and small-lump materials mixed with fines, weighing up to 40-50 lb. per cubic foot. In this class are such substances as cottonseed and light soda ash. Non-abrasive and semi-abrasive materials, as well as those containing small lumps mixed with fines, in the range from 40 to 75 lb. per cubic foot, comprise Class III. This group includes such materials as bituminous coal, refined sugar, coarse salt and dense soda ash. Class IV materials comprise those of granular, semi-abrasive or abrasive character, or consisting of mixtures of small lumps and fines, in the range from 50 to 100 lb. per cubic foot. In this class are cement, shale, gypsum and ground lime.

This classification of materials on the basis of permissible loading can be used as a means for determining safe carrying capacity of conveyors at various speeds of operation. Charts have been developed for this purpose and are presented in Figs. 4 to 7. These show the volume of material in cubic feet per hour passing a given point in the conveyor trough when the screw turns at a particu-

Fig. 4—Above: Capacity chart for Class I materials, such as air-separated hydrated lime

Fig. 5—Below: Capacity chart for Class II materials, such as light soda ash

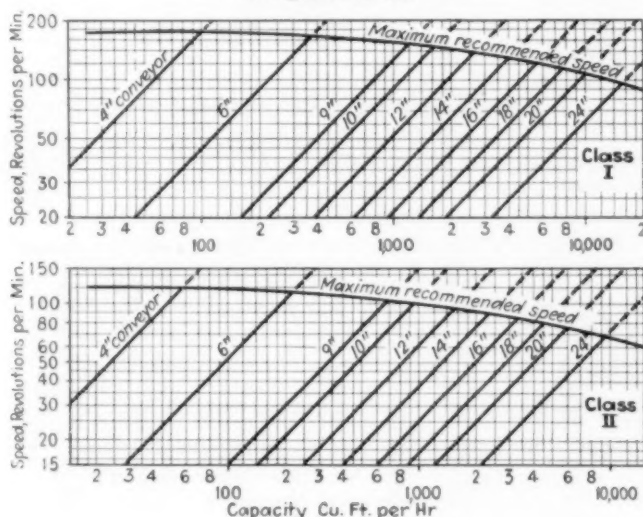
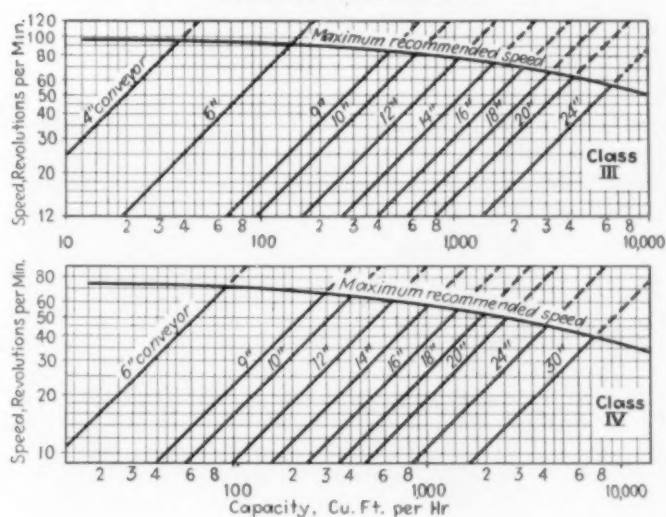


Fig. 6—Above: Capacity chart for Class III materials, such as dense soda ash

Fig. 7—Below: Capacity chart for Class IV materials, such as cement and shale



lar rate of speed and when the conveyor is fed uniformly so that the average cross-sectional area of material is as specified. A fifth chart, Fig. 8, applies to all of the materials of Table I, but only for the determination of the capacity of horizontal screw feeders, operating full. Each of the first four charts carries a boundary curve representing the maximum rotational speed recommended for standard screw conveyors. Conservative speeds for screw feeders may range as high as 200 r.p.m., which is possible because hangers are not ordinarily used in such installations.

The choice of a conveyor, then, can be determined by the joint use of Table I and the applicable chart of Figs. 4 to 7. In the third column of the table is given the loading classification for each material. For a Class II substance such as pulverized alum, for example, Fig. 5 is used. From this chart it is evident that a 6-in. conveyor will deliver 95 cu.ft. per hour at a speed of 50 r.p.m., while at the same speed, a 12-in. screw will deliver 820 cu.ft. per hour. For a 6-in. conveyor the maximum recommended speed is 114 r.p.m., and for a 12-in. conveyor 95 r.p.m.

Capacities as given by the charts are for materials containing lumps not greater than are suitable for the conveyor size chosen. The maximum lump size that can be handled successfully depends on the screw diameter, the percentage of lumps to the total material and, to some extent, on whether the lumps can be partly crushed by the conveyor. When the material is all lumps, the maximum size permissible is smaller than when the lumps comprise only 20-25 per cent of the total. Table II shows the maximum sizes that are recommended for handling, under both conditions, in various sizes of conveyor. The clearance between the flights and the trough should be increased to approximately the average lump size when handling materials containing a large percentage of lumps which do not crush easily.

Table I also gives, in the second column, the approximate weight per cubic foot of each of the materials listed. These weights are for materials slightly agitated or fluffed, as they are when handled in conveyors, and are generally less than when the materials are settled or packed in bins or containers. The fourth column recommends suitable types of hanger bearings and couplings for each material. Where water lubrication is permissible, bearings of molded, impregnated textile fabrics are sometimes used. In some cases these bearings need not be lubricated.

Power Consumption of Conveyors

In the last column of Table I is given a factor for each material which may be used in conjunction with Table III and the following formula in calculating the horsepower requirements of conveyors. The formula is a new one which for the first time takes into consideration all of the important operating variables:

$$\text{Horsepower} = 1 + \frac{ALN + CWLF}{1,000,000}$$

where A = Factor for conveyor size, as given in Table III.

L = Length of conveyor, in feet.

N = Speed of conveyor, in r.p.m.

C = Quantity of material conveyed, in cubic feet per hour.

W = Weight of material, in pounds per cubic foot.

F = Horsepower factor, as given in Table I.

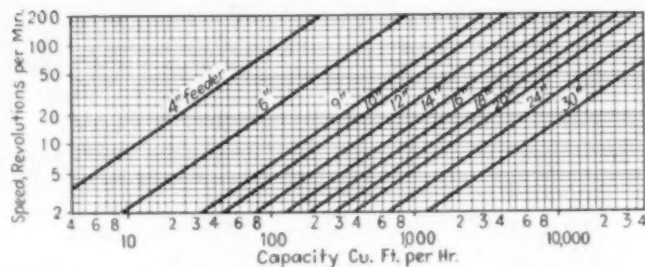


Fig. 8—Capacity chart for screw feeders on all materials listed in Table I

This formula does not include any allowance for misalignment of the conveyor nor for starting the screw when the trough is packed with material. Otherwise, however, it gives the most reliable results yet obtainable by means of a formula.

Effect of Conveyor Inclination

The discussion heretofore has applied only to horizontal conveyors. For inclined conveyors operating at angles up to 15-20 deg. from the horizontal, the power requirements may be derived with fair accuracy by adding the power required to elevate the material to that determined by the horsepower formula for horizontal conveyors. For steeper inclines no simple method yielding reliable results is available. Similarly, for conveyors inclined up to about 20 deg., the decrease in capacity, caused by slip, can be predicted with a good degree of approximation. For standard pitch conveyors the following percentage slip factors can be applied to the capacity as determined from the charts:

- 10-deg. incline—85 per cent of chart capacity
- 15-deg. incline—80 per cent of chart capacity
- 20-deg. incline—60 per cent of chart capacity

Above a 20-deg. inclination the delivery, as with the horsepower, can not be simply determined for the results will depend on design variations employed for the steeper slopes. From about 20 deg. to vertical, for example, conveyors generally have short-pitch flights, rather than standard. From perhaps 25 deg. to vertical, they use cylindrical housings instead of open troughs. From about 40 deg. to vertical they require close instead of standard clearance between flights and housing, while in those designs that are vertical or nearly so, hangers are omitted entirely.

Table II—Maximum Size of Lumps, Inches

	Diameter of Conveyor, Inches									
	3	4	6	9	10	12	14	16	18	20
Lumps 20 to 25% of total.....	1	1 1/2	2	3	4	5	6	8	10	12
All lumps.....	1	1 1/2	2	3	4	5	6	8	10	12

Table III—"A" Factors for Conveyor Horsepower Determination

Size of Conveyor, Inches	Type of Hanger Bearings		
	Lignum Vitae, Babbitt or Bronze	Self-Lubricating Bronze	White Iron or Stellite
3	15	24	36
4	21	33	51
6	33	54	78
9	54	96	132
10	66	114	162
12	96	171	246
14	135	255	345
16	186	336	480
18	240	414	585
20	285	510	705
24	390	690	945
30	549	975	1,320

Approximate Determination of Specific Heats of Liquids

By G. E. SEAVOY
Chemical Engineer
Swenson Evaporator Co.
New York, N. Y.

SPECIFIC HEATS of many liquids and solutions are yet unobtainable from published critical data. This is especially true for aqueous solutions of complex nature, *e.g.*, those mixed solutes with which the plant and chemical engineer are frequently concerned.

The author has frequently used the method described below to determine the specific heat of unusual aqueous solutions for the purpose of equipment design. Sufficiently accurate results can readily be obtained and in the case of complex solutions the method gives results which, if estimated by some of the more commonly known methods of approximation, would be erroneous. The error by such empirical formulas, more often than not, will be in the wrong direction for conservative purposes of design.

The method is simple and involves the evaporative cooling of the liquid solution over a relatively short temperature range. Successive increase in vacuum causes evaporation of the solvent, usually water. The condensate is weighed and its equivalent latent heat represents the change in sensible heat of the solution, over the temperature range of cooling.

The determination can readily be carried out in laboratory apparatus which consists of a 1- or 2-liter dewar flask (to minimize radiation), a glass condenser packed in ice, a condensate receiver and suitable vacuum producing equipment. Provision should be made to have a thermometer immersed in the solution and, if possible, a manometer or absolute pressure gage in the system. A weighed quantity of the solution is cooled as quickly as possible without too violent boiling and consequent entrainment. If W is the initial weight of the solution and w is the weight of the condensate when the solution has been cooled from t_1 to t_2 , then the specific heat is approximately:

$$\frac{wL}{(W-w/2)(t_1-t_2)}$$

where L is the average latent heat of vaporization for the absolute pressure range corresponding to the final and initial temperatures of saturated vapor. It will be noted that the specific heat is obviously that at the average temperature and concentration.

A number of assumptions are involved in the equation and correction can be made for deviations from these if more accurate results are desired. The following are the assumptions:

1. No change in phases of the system.
2. No decomposition of components to affect analyses or temperatures.
3. No radiation or condensation on the inner or outer walls of the dewar flask.
4. No heat-of-dilution effect.
5. No appreciable variation in specific heat with the

small change in concentration caused by the evaporation.

6. Solute has no appreciable vapor pressure, *i.e.*, only water or pure solvent is vaporized.

The dewar flask will reduce radiation and condensation errors to a minimum, but a blank radiation test can be run beforehand in the temperature range to be used later.

If the solution has an appreciable boiling point rise the vapor will be superheated accordingly, for which correction can be made.

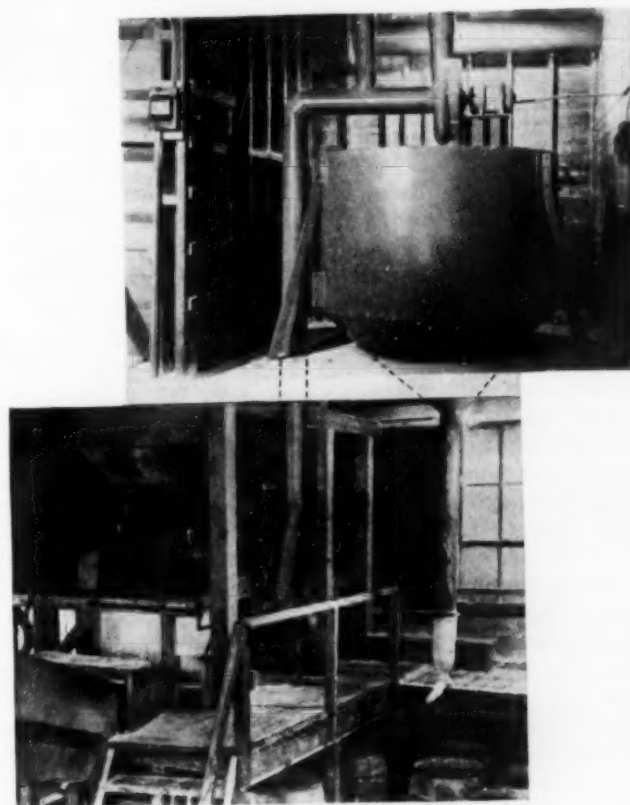
The evaporation can be checked from chemical analyses before and after cooling.

If the vapor has two components it will be necessary to analyze the condensate and calculate the heat removal from the respective latent heats.

The method can be used for solutions of high boiling point rise and concentration by working at a higher temperature level. This, of course, assumes no great error in specific heat with temperature.

The change in concentration of the sample on account of the evaporation is relatively small with a considerable temperature range of cooling. A liter sample cooled 30 to 40 deg. makes a fair-sized test.

Delbert E. Jack, Berkeley, Calif., has supplied the two interesting views below, showing an installation of an American Air Filter Roto-Clone, collecting dust from a soap-grinding operation in the plant of Gordon Allen, Ltd., Oakland, Calif. It is necessary to draw cold air into the two hammer mills to prevent the soap from softening. Prior to the installation of the Roto-Clone, the bag filter used gave continual trouble on account of the heavy concentration of fine dust—200 lb. per hour and 15 per cent through 200 mesh. With the Roto-Clone, 94 per cent of the dust is continuously precipitated into the tank, the remainder being caught in the filter which now requires cleaning but twice a year.





Enamel-lined developing vats at Universal Studios

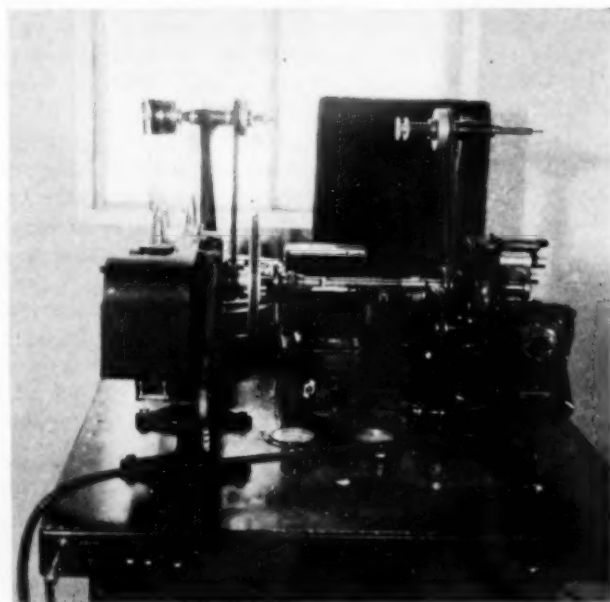
By A. B. LAING
Hollywood, Calif.

CHEMICAL ENGINEERING IN THE

FACED with the problem of keeping down operating expenses the movie industry has adopted the highest class of technical equipment in its chemical operations. The automatic developing process, for instance, presents a good example of up-to-date chemical engineering, in design as well as in operating control. An outstanding piece of equipment in this field is the continuous developing machine recently perfected by C. Roy Hunter, superintendent of photography for Universal Pictures Corp., and his associate, Robt. M. Pierce. The exposed film, in passing through this machine, is developed, rinsed, fixed, washed, cleaned, and dried in continuous operation, at the rate of 120 ft. per min. Eight of these machines are in operation at the Universal studios.

All chemicals used in the development are stored in dustproof hinged bins, close to weighing machines and mixing vats. The latter are of steel, glass lined, and equipped with Monel metal impellers; all pumps and pipe lines are of acid resistant steel or hard rubber. The old "pyro" solution has given way to the borax and other fine-grain methods, and sulphuric acid is used to arrest development. The developer is circulated through each machine at a rate of about 25 gal. per min.

Water for rinsing, used at a rate of 12 gal. per min. in each machine, is passed through a softening and filtering process prior to use. Neon tubes are used for lighting, and the final drying of the finished film is done with air, carefully cleaned to remove every trace of oil, and brought to the correct temperature and humidity in a Carrier air conditioning plant with a capacity of 110 tons of refrigeration.



Machine for testing synchronization of sound and action

An elaborate system of Brown recording instruments, mounted on a central panel, permits complete supervision of the temperature of the air and all solutions, of humidity of the air in the building and of the speed of the film through the machines.

Silver Salvage and Solution Recovery

Salvage of silver from old hypo solutions has become a highly profitable undertaking in many of the larger studios. In one studio, for instance, where a total of

16,000,000 ft. of film is run through the developing machines every month, the salvaged silver totals approximately 9,000 oz. per month, a cash reclamation sufficient to pay for all chemicals purchased. In addition, the old hypo is automatically regenerated for further use, an added advantage to the producer.

A rather humorous incident led to the adoption of the present practice. Constantly clogged pipe lines from the vitiated hypo vats in one studio caused costly laboratory shut-downs a few years ago. Each time the same plumber was called in to make the necessary repairs. To every call he responded with remarkable promptness, digging up the pipe, removing the old lengths, and replacing them with new pipe. Suspicion was finally aroused, particularly because the bills presented for this service seemed entirely too low in view of the work involved. Upon investigation it was found that by laying some lengths of pipe out of level, at the end of the line, which would always be filled with old hypo solution, the plumber had

It was therefore a veritable silver mine which our ingenious plumber had been diligently working up to the time when the owner of the studio, exercising his priority rights, jumped his claim and terminated his highly profitable "contract."

Since that time several methods of processing high-silver hypo solution have been tried, less with the hope of profit from recovering silver than to discovering a means of keeping the hypo fresh to expedite and simplify film development.

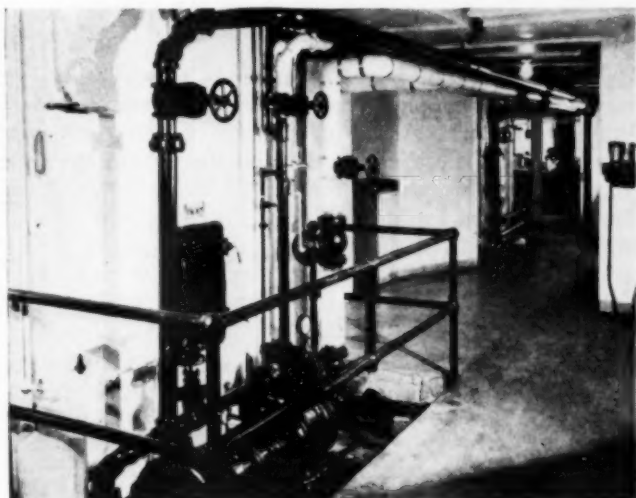
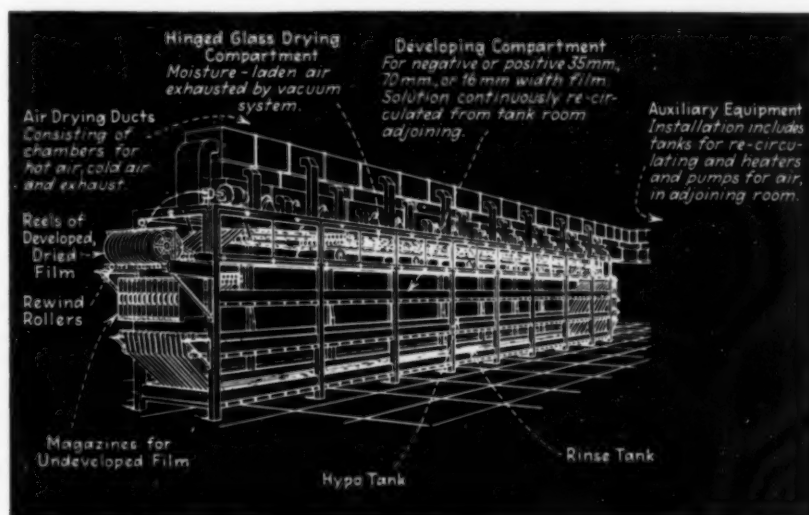
For a time Hollywood contractors did a thriving business pumping old hypo from the dark rooms to their tank cars, later selling it back to the studio on the basis of a 75 per cent draw back. This is still being done by some of the smaller producers.

As a perquisite of the profession chemists in Hollywood laboratories were once permitted to scrape off all silver adhering to bolt heads and other protruding metal parts in the various vats and containers. This franchise

MOVIES

Continuous developing machine capable of handling 10,000 ft. of pos. film per hour

Air washers at Paramount laboratories handling 80,000 cu.ft. of air per min.



deliberately constructed a hypo-trap of about 100 ft. length, in which silver dissolved from the films during the process of developing was precipitated on the metallic iron.

paid from five to ten dollars a week per man, until one day some greedy operator was caught troling and seining in the baths with an elaborate device constructed of metal cloth. Since then more satisfactory methods were adopted by Paramount, Universal, and other of the large companies. The hypo solution was pumped to 1,200 gal. tanks of acidproof cement where silver was precipitated on zinc fillings or with hydrogen sulphide. After three days' settling the clear supernatant liquid was decanted off, while the remaining sludge was dewatered and reduced to metallic silver in crucibles. The solution ran as high as \$1 of silver per gallon. This procedure did not, however, recover the valuable chemicals.

Finally the present electrolytic method became standard practice. Wooden cells, 4x4x3 ft., in which are suspended thirteen 22x30 in. iron plates, 1/4-in. thick, spaced at about 2 in., are used. The cells are equipped with mechanical agitators to insure good deposition. As high as 11 lb. of silver may be stripped from each plate. After removal of the silver the solution may again be used in developing.

Welding Pipe and Pressure Vessel Joints in Chemical Industries

By C. O. SANDSTROM

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Editors' Note—This is the second of two articles by Mr. Sandstrom on the design of welded joints for chemical plant equipment. The first, which appeared in the July, 1934, issue of *Chem. & Met.*, dealt with the weldability of metals and the characteristics of various weld types. The present article discusses the welding of pipe, pipe nipples and their reinforcing rings, fired and unfired pressure vessels, and flanges. For the benefit of engineers who are concerned with the design of equipment supports, working platforms and buildings, Mr. Sandstrom has prepared a third article to appear at an early date, which contains much information of practical value on the use of welded structural shapes for these purposes.

ANYONE who has gazed upon the multitudinous flanges and fittings making up the average piping system, or has had charge of its maintenance, should be in a receptive mood toward welding. Welded piping not only presents a neater appearance but, because of the absence of gaskets, is less likely to leak. Except in special cases it also costs less. Covering of welded piping costs less because of the absence of flanges and fittings. Often the flanges and fittings are left uncovered because of the cost and the difficulty of applying, which presents a large surface for the loss of heat by radiation—a loss prevented by the installation of welded piping. There is now available a line of cast-steel flangeless valves and fittings for welding to pipe. The advantages of this need not be argued.

In Fig. 1a is shown a typical pipe weld. Generally the V is 90-deg., but it is doubtful if its use in the majority of cases offers sufficient advantage to compensate the added weld metal required. As the axial stress due to internal pressure is only one-half the bursting (hoop) stress, the only need for great strength in the case of piping is where it is subject to both internal pressure and an additional transverse stress due to long spans, and to handling during erection. Making the transverse and longitudinal seams of steam boilers equally strong is not thought necessary or desirable.

Occasionally we see pipe-connection designs, intended to develop the full strength of the pipe, and bordering on the fantastic. Two examples, not fantastic, however, but having no special advantages, are shown in

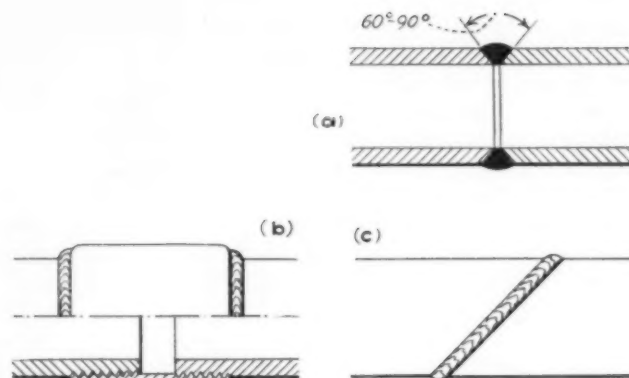


Fig. 1—Pipe joints; that at (a) is always suitable, while those at (b) and (c) are expensive and offer no special advantages



Fig. 2—Two methods of fabricating elbows by welding

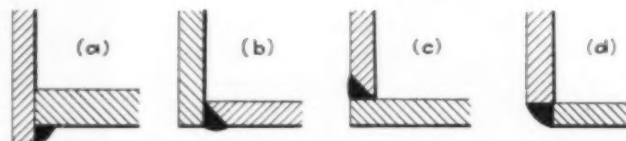


Fig. 3—Four methods of closing the end of a pipe

Figs. 1b and c. In Fig. 1b the ends of the pipe are screwed into a coupling and the ends of the coupling welded to the pipe. Assuming that the shearing strength of the thread is sufficient to develop the tensile strength of the pipe at the root of the thread, then the total resistance is the metal in the section at the root of the thread, and the weld. But as the weld is first in the line of stress it must yield before the threads can become effective. It is seen that this joint is in the category of the combinations of riveted and welded joints discussed in the preceding article (July, 1934) and does not justify its comparatively great cost.

The joint in Fig. 1c was proposed as a means of providing a greater welded area and consequently increased efficiency. While the diagonal weld does provide greater strength in simple tension and compression in the case of a 45-deg. diagonal the weld is along the line of maximum shear. And under transverse loading the maximum fiber stress is in the weld for any position of rotation of the pipe.

If the efficiency of the V-weld of Fig. 1a were only 80 per cent, whatever device is adopted to increase its

strength, only 25 per cent improvement is possible. So it seems that rather than experiment with costly "trick" joints one should make an effort to obtain maximum efficiency with the common V type. Of course, some such joints have the appearance of great strength (the one shown in Fig. 1b for instance), but the strength is more apparent than real. I do not minimize the psychological effect of such things as "trick" joints, but engineering is applied science and as such should not rely on tricks, nor on psychological effects.

Elbows may be made up as shown in Figs. 2a and b. The one shown in Fig. 2b offers less resistance to the flow of the fluid but the one in Fig. 2a is more easily made up, having one less weld, besides being easier to square and line up.

Four methods of closing the end of a pipe are shown in Figs. 3a, b, c, and d. The plate must be proportioned for the transverse stress imposed by the pressure and will be much thicker than the pipe. The thickness of plate for the joint of Fig. 3a must be based on the assumption that the plate is merely supported at the edges—the weld not providing fixity or restraint. In the joint of Fig. 3b, however, the inside fibers of the plate are somewhat restrained by the weld which, consequently, produces a stronger joint. But since there is slight economy of material effected by designing for partial restraint of the edge of the plate, and as the walls of the pipe can never provide complete restraint, all flat pipe closures should be designed for merely supported edges. Large pipe may have closures varying from plain dished plates to dished-and-flanged heads similar to boiler heads.

In Figs. 4a, b, c, and d are a variety of pipe nipples welded to larger pipe or vessels. The weld in Fig. 4c is a very good one, but it calls for a countersunk hole. Nipples inserted in the holes as in Figs. 4b and c may have the ends taper-reamed to reduce hydraulic losses. Standard pipe may be used for these connections up to 4-in. size and for pressures up to 150 lb. per sq. in., above which extra-strong pipe should be used.

Large nipples require large holes in the vessels to which they are welded; and large holes seriously weaken the shell. The weld and a portion of the nipple are effective in resisting the bursting stress in the shell.

Where the hole is so large that the assigned portion of the nipple does not compensate the portion of the shell removed, then there must be added a reinforcing ring or flange. It should be remembered, however, that the strength to be attained need not exceed the strength of the joint in the shell, which may be anything from 50 per cent to nearly the full strength of the plate, depending upon the type of joint. We sometimes observe apparatus whose joints have efficiencies on the order of 50 per cent, equipped with details that bear evidence of efforts to attain 100 per cent. The adage about the chain and its weakest link may sometimes be invoked with profit.

A study of the plan and sectional views of Fig. 5 will disclose that the tendency of the shell to rupture is resisted by the weld metal and a portion of the nipple; and rupture may or may not include the nipple, depending upon its thickness and the thoroughness of the union of the weld metal with the base or parent metal. With a nipple thicker than the shell, the resistance along the axis would be so great that failure would occur in the shell approximately along the line B-B which follows the outside of the weld.

In order that the nipple may replace the metal removed from the shell in cutting the hole, there would be required a sectional area equal to the diameter of the hole, multiplied by the thickness of the shell. For example: If a hole were cut in a $\frac{1}{2}$ -in. shell to accommodate a 6-in. nipple, the sectional area of the metal removed would be $6.625 \times 0.5 = 3.313$ sq. in. The length of 6-in. extra-strong pipe of equivalent area is $3.313/2 \times 0.432 = 3.84$ in. = length L of Fig. 5. Reduced to an equation this becomes $L = 0.5 d t/t_2$. The limitation on this equation should be that l should not exceed $8t_2$. The maximum diameter of nipple that may be used without a reinforcing flange is then $d = 2t_2(16t_2 + t)t$; which for a $\frac{1}{2}$ -in. shell is 3 in. standard and for a $\frac{3}{8}$ -in., 12 in. standard. Nipples of the same thickness as the shell would have outside diameters varying from 12.75 in. for $\frac{3}{8}$ -in. shell plate to 34 in. for 1-in. shell plate. The figure shows two methods of welding the nipple to the shell.

Frequently it is impossible, or inconvenient, to have

Fig. 4—Four methods of welding nipples into larger pipe, or vessels, when the nipple is small enough not to require reinforcement

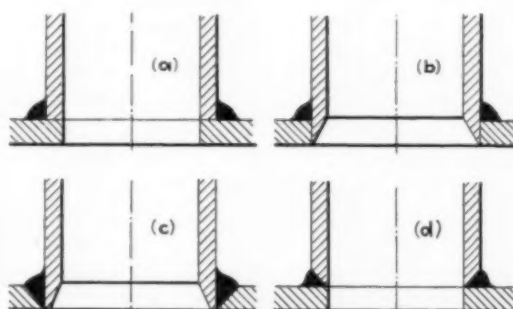


Fig. 4

Fig. 5—Nipple extending within the shell to illustrate maximum nipple diameter that can be used without reinforcement

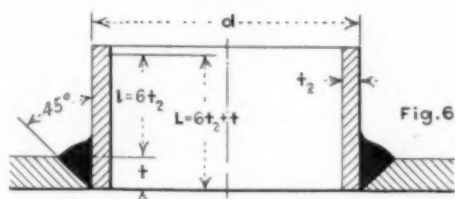


Fig. 6

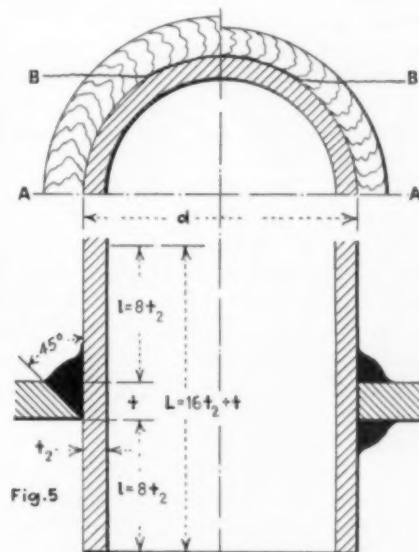


Fig. 5

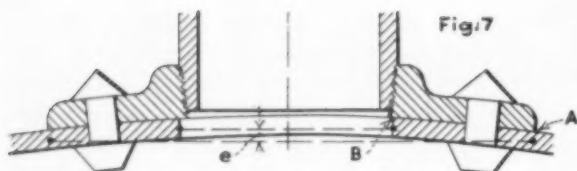


Fig. 7—Riveted reinforcing flange, illustrating eccentricity

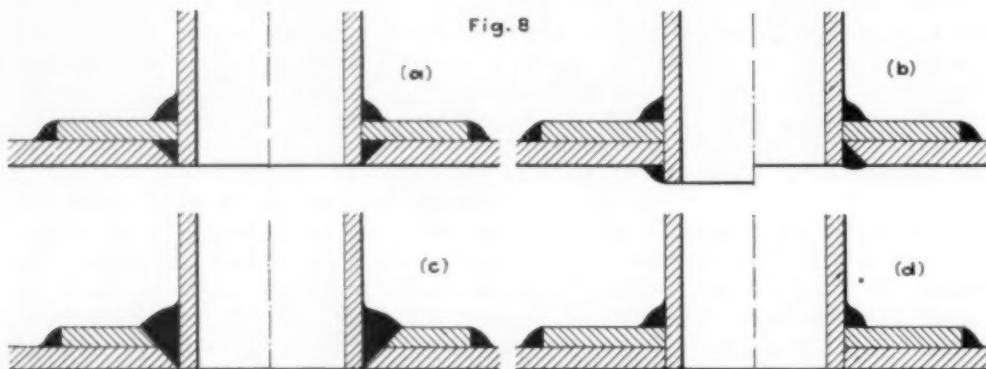
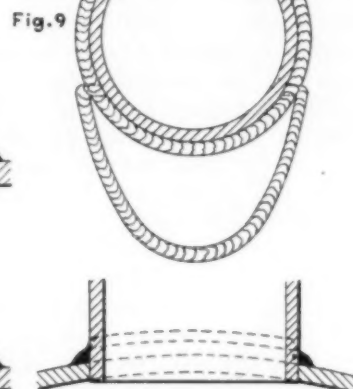


Fig. 8—Four welded nipples with reinforcing flanges. (a) and (b) are the best for, respectively, outside and inside welding

Fig. 9—Ideal shape for welded reinforcement



the nipple project inside the shell and it must be installed as shown in Fig. 6. It is obvious that this connection is not as strong as the one in Fig. 5 because of the high stress at the edge of the nipple. Allowing a value of l of $6t_2$ the equation for this case becomes $d = 2t_2(6t_2 + t)/t$.

Design according to the foregoing precludes the use of nipples thinner than the shell to which they are welded, but this need not deter us from the use of thin nipples of small diameter, because the excess metal in the shell required by a consideration of joint efficiency allows some latitude. I would consider a 4-in. standard pipe nipple the maximum size, however, for use as shown in Fig. 6, above which size extra-strong pipe should be used.

Reinforcing Flanges

When a nipple welded to a pressure vessel does not compensate the metal removed from the shell in cutting the hole, then recourse must be had to a reinforcing ring, or flange. The flange used for connecting piping to pressure vessels, in which the pipe is screwed into the flange, and the flange riveted to the vessel, is far inferior to a welded flange. A study of the riveted flange shown in Fig. 7, and a knowledge of the means of making the flange tight—that is, by calking the outer edge, A —will convince one that this kind of "reinforcement" is not as effective as it seems. The common impression is that the function of the flange is to replace the metal removed in making the hole, and when this is done the weakness has been compensated. But unless the inner edge, B , is fluid tight, the pressure will extend through the joint to the outer edge, A . This being the case, the area of the shell within the diameter of the flange has pressure on both sides and, consequently, does not receive the stress as a hoop, but as a curved tie which is under transverse stress due to the eccentricity, e , of its axis. The flange, then, must replace not only the metal removed in cutting the hole but a large part of the shell under the flange; and besides must resist the bursting stress caused by screwing up the pipe.

In Figs. 8a, b, c, and d are shown several methods

of welding nipples with reinforcing rings. The one in Fig. 8a probably is the best where an inside weld is not feasible. That in Fig. 8b may be used where the inside is accessible. The one in Fig. 8c would require an excess of weld metal because of the increasing width of the V with increasing thickness of the plate. The one in Fig. 8d is frequently used, but it has the same objection as the riveted flange of Fig. 7, in that the pressure can communicate with the space between flange and shell, and should, therefore, be avoided.

The diameters and thicknesses of the flanges shown need only be sufficient to compensate the metal cut away for the hole; and the effective area of the nipple is found as discussed in connection with Fig. 6. Following is a practical example of the design of a pressure vessel with a nipple as shown in Fig. 8b. It is desired to weld a 6-in. extra-strong nipple to a shell 48 in. in diameter.

D = Inside diameter of shell = 48 in.

d = Outside diameter of nipple that may be used without a reinforcing ring.

P = Working pressure = 250 lb. per sq.in.

t = Thickness of shell plate.

t_2 = Thickness of nipple = 0.432 in.

E = Efficiency of weld = 80 per cent.

S = Allowable working strength of plate = 11,000 lb. per sq.in.

Then $t = \frac{48 \times 250}{2 \times 11,000 \times 0.80} = 0.682$ or, say, $\frac{11}{16}$ or 0.6875 in. for the thickness of the shell. The outside diameter of nipple that may be used without a reinforcing ring = $d = \frac{2 \times 0.432 (6 \times 0.432 + 0.6875)}{0.6875} =$

4.12 in. which is less than the diameter of a 6-in. nipple (6.625 in. O.D.). Therefore, it is necessary to provide a flange whose cross-sectional area equals $(6.625 - 4.12) 0.6875 = 1.72$ sq.in. As a thick flange requires more than a proportionate amount of weld metal we shall use a flange $\frac{1}{2}$ in. thick, the outside diameter of which is $(1.72/0.5) + 6.625 = 10.07$ in. This flange is much smaller than a riveted flange for the same service and can be applied for a fraction of the cost of a riveted flange.

A correctly designed reinforcing flange for welding

would not be circular at all—it would be elliptical. Circular flanges were necessary to accommodate the rivets. Since the hole in the plate has its maximum effect along a longitudinal axis of the flange, decreasing to a minimum at the extremities of the transverse axis, the flange, or rather the reinforcement, could be made as in Fig. 9. If maximum efficiency at the longitudinal tangents of the nipple is desired, the flange may be made as wide as desired. All the nipples discussed may be improved in appearance by welding the reinforcing flanges to the inside of the shell.

Unfired Pressure Vessels

By unfired vessel is meant any vessel subjected to pressure of liquids or gases, but which is not provided with a furnace for heating the contents. In this class are oil refinery equipment such as steam stills, absorption towers, reflux towers, condensers and heat-exchangers, and storage tanks; power-plant equipment such as feedwater heaters, water-treating apparatus and fuel storage tanks; ice-plant equipment such as brine tanks, reboilers, accumulators, shell-and-tube ammonia condensers, absorbers, rectifiers and stills; and innumerable other pieces of apparatus used in process industries.

After the type of joint to be used in the shell has been decided upon, comes consideration of the heads and the various pipe connections. A much too common type of head joint has been that shown in Fig. 10, which is merely a dished plate welded to the shell. The head with a portion of the shell, under internal pressure, tends to form a sphere, as indicated by the dotted line, causing extremely high stresses in the weld. Repeated variations

of the pressure produces a "breathing" action and failure is assured; the only uncertain factor being time. There have been many failures of this type of head, resulting in loss of life and property—and welding has in nearly every instance received a "black eye."

The pressure under the head produces tension in the weld that has a horizontal component producing compression in the end of the shell. The compressive stress is, of course, slightly relieved by the tensile, or hoop, stress, incident to the pressure in the shell; but the stresses to consider in design are the transverse ones in the weld and the compressive one in the end of the shell.

A truly circular shell is the exception rather than the rule, so there results a complication of stresses that tend to produce a spherical head and a truly circular shell. At the same time the ordinary shear and tensile stresses in the weld are aggravated by the distortion resulting from the tendency of the shell to assume a perfect circle. Altogether, this is a very undesirable head to use in a tank subject to varying pressure.

The common practice of stating loads in pressure vessels in terms of pressures in pounds per square inch has, I think, been conducive to faulty design. Some years ago the head of a gasoline tank 84 in. in diameter, and welded as shown in Fig. 10, failed and the resulting fire caused the loss of six lives and the destruction of many thousands of dollars' worth of property. The working, or pumping, pressure was 30 lb. per sq.in. The shell was of $\frac{3}{8}$ -in. and the heads of $\frac{5}{16}$ -in. plate. The head evidently was designed according to the old boiler-head formula which presupposes a flange at the periphery. The formula would not be applicable, however, to such a large diameter. Had the designer computed the total load carried by the head he would have found it to be $84^2 \pi 30/4 = 166,260$ lb. Even the "greenest" designer would have hesitated about placing a load of 83 tons on such construction.

The very convenience of fusion welding makes possible such "design" as the foregoing. Had the head been riveted, a flange would have been necessary, and the junction of cylinder and sphere would have been a fillet instead of a sharp corner; and would have had more than double the thickness of metal at the end of the shell to resist the collapsing force.

Vessel Heads

In Figs. 11a and b are shown typical boiler heads butt-welded to the shells. The weld may be either single- or double-V. The double-V necessitates inside welding which is not so convenient as the single-V that is applied entirely from the outside. The butt weld also requires nearly perfect mating of the head and shell.

In Figs. 11c and d are heads with the flanges inserted into the shell. While this type requires two welds, it probably is justified by the conveniences of construction. The double thickness of metal also increases greatly the resistance to collapse. The head of Fig. 11d is entered too far into the shell. Heads fitted in this manner are hard to distinguish from the simple dished head of Fig. 10.

In Figs. 12a and b are heads with the pressure applied to the convex sides. This type of head is sometimes called a concave head because the concave side is in sight of the observer; and the head discussed in the preceding

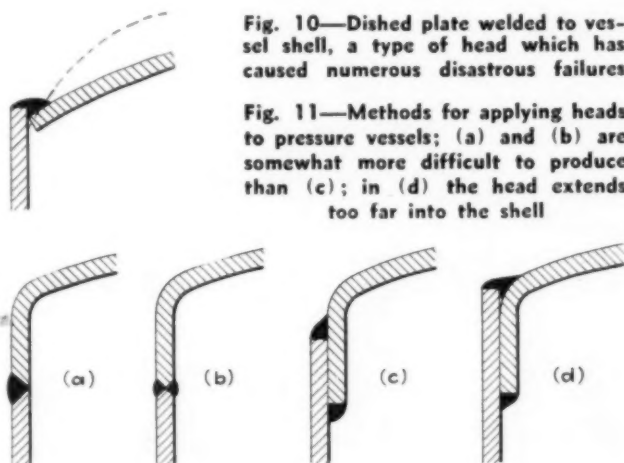
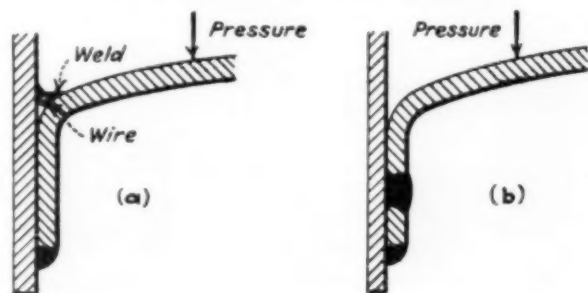


Fig. 12—Types of head for vessels in which the pressure is applied to the convex side



paragraph is sometimes called a convex head for the same reason. It seems that a better means of identifying the heads is to name them according to the side subject to pressure. The head shown in Fig. 11c would then be a concave head while the one in Fig. 12a is called a convex head.

The head of Fig. 12a differs from the one of Fig. 11c in that the stresses are reversed; that is, the stresses in the flange and shell are tensile. In practice this type of head is sometimes welded on the inside—a rather difficult job. In order to economize on weld metal, a wire is driven into the space between the head and the shell and weld metal applied as shown. It would seem, however, that the weld at the edge of the flange should be sufficient. The weld is in practically simple shear, and the shell and flange are in tension, the latter modified by the pressure of the fluid that finds its way into the head joint.

Should a "psychological" effect be desired, plug welds may be applied as shown in Fig. 12b; but it should be remembered that every weld that connects with a pressure space increases the possibilities of leaks.

Sometimes a concave head (pressure on concave side) is applied to a shell that also serves as the support of the vessel as shown in Fig. 13a. This, however, is not always a satisfactory job. To be insured against leaks the outside must be wired and welded, which calls for a quantity of welding that is out of proportion to the benefits. Better jobs are shown in Figs. 13b, c and d. In Fig. 13b a conical plate is welded to the head and to an angle ring; in Fig. 13c a channel is used instead of the angle. In Fig. 13d a number of steel tees or angles are used which gives somewhat the appearance of a spoked wheel. With the latter methods the joint is accessible for inspection, and for calking to seal any leaks that may develop.

(A discussion of heads for pressure vessels may be found in the author's article in *Chem. & Met.*, Dec., 1932, pp. 668-72.)

Fired Pressure Vessels

Welding of high-pressure steam boilers has lately been sanctioned, but under restrictions that confine their manufacture to plants equipped with X-ray apparatus for the exploration of the seam. This, of course, keeps the "jerry" builder out of the field, but appears to exalt the long-accepted riveted joint at the expense of welding. The real obstacle to welding seems to have been not of technology but of psychology. Anyone who can flinch at the thought of a welded joint, and then unhesitatingly accept a product that may have been tortured into shape and tightness by means of drift pin and calking tool, is a victim of lack of information, on the one hand, and credulity on the other. Recent investigations indicate that caustic embrittlement favors areas of boiler plate that have been subjected to the working necessary to produce tight riveted joints. Welded joints apparently are free from this defect.

In some types of steam boilers the strength of the drum or shell is determined by the strength of the plate through a line of rivet holes; and in other types the strength is based on the sectional area through a line of tube holes. A triple-riveted, double-strap butt joint in a $\frac{1}{2}$ -in. plate may attain an efficiency (calculated) of 88 per

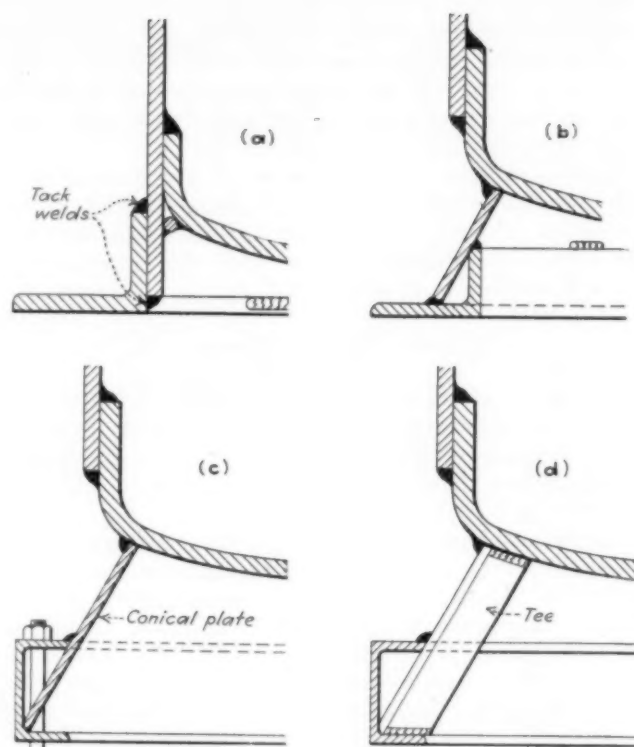
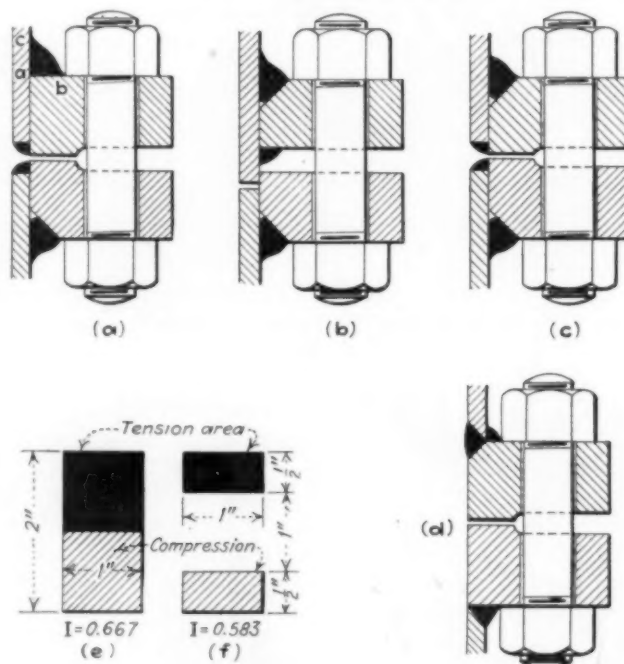


Fig. 13—Methods of supporting pressure vessels on end; that at (a) is usually not as satisfactory as the others shown

cent, but the efficiency through the tube holes is, with a common size hole and spacing, only 45 per cent. Welded joints made by skilled workmen attain higher efficiencies than 88 per cent—and an efficiency of only 45 per cent can be regarded extremely poor work!

Fig. 14—Methods of attaching flanges and, at (e) and (f), a demonstration of the effect of incomplete filling of the V with weld metal



Flanges

The properties of steel make it a more reliable material than cast iron for pipe flanges. Steel of structural grade has about three times the tensile strength and a modulus of elasticity of about twice that of the better grade of cast iron. As the strength of a beam varies as the square of the depth, the steel beam need be but a little more than half the depth of a cast-iron beam of the same width and for the same loading. And for the same dimensions and loading, the steel beam would have one-half the deflection of the cast-iron beam; but for the same deflection the steel beam would have to be about 8/10 the depth of the cast-iron beam.

Pipe flanges and others must all be designed to resist the rupturing tendency of the pressure within the pipe or vessel, and also the transverse stresses caused by tightening the bolts to obtain non-leak joints. In fact, it might be said that the first consideration in the design of bolted pressure vessels is the man with the wrench—the direct pressure being frequently an unimportant item. That this fact is not always given the consideration that it deserves is manifested by vessels sometimes found in which the bolts were evidently designed for the fluid pressure alone.

The upper flange in Fig. 14a shows what probably is the simplest welded flange. The angle between the top of the flange and the wall of the vessel is joined with weld metal. It is obvious that the bending of the flange by the bolts produces a shearing force in the weld along *a-b*, but a greatly eccentric, or tearing, stress along *a-c*. Under this kind of loading the stress at *a* in the plane *a-c* is four times the average over the section. The lower flange has been beveled to form a V between it and the wall. In this case the weld metal unites a greater area of the tension fibers of the flange to the wall, reducing the eccentricity and increasing the strength.

In Fig. 14b the ends of the shell are brought into contact in a male-and-female engagement. In a modification of this type one flange is rabbeted to receive the end of the mating shell.

In Figs. 14c and d is shown the effect on the diameter of the bolt circle of two methods of welding the flanges to the vessel. In d the weld fillet does not encroach so far out on the flange as in c and results in smaller diameters and a smaller area under pressure.

Welding the flange to the shell brings a portion of the shell into the service of resisting the transverse stresses set up by tightening the bolts. What length of shell is effective cannot be predicted, however, but a convenient assumption is six times its thickness. It is seldom that the transverse strength along a diameter is the determining factor in the strength of a welded flange, since excessive pressure of one or several nuts may cause local failure of the weld. In most cases, then, design would consider the transverse strength of a unit length of the weld.

Undue importance may be attached to completely filling the V's with weld metal. Assuming that the attachment is sufficiently rigid to permit a unit length of the flange to act as a cantilever, the extreme fibers of the weld carry the maximum tensile stresses, reducing to zero at the neutral axis. As the bottom of the V is then at the neutral axis, failure to fill it completely is not of much importance. Fig. 14e shows an elementary width of a homogeneous section of a flange. Its moment of

inertia is 0.667 in.⁴. Fig. 14f represents the section welded to only one-fourth of its depth, with an equal compression area. The moment of inertia in this case is 0.583 in.⁴, or about 88 per cent of that of sketch e.

Flanges that are not joined to the wall, as the Van Stone type, for example, must of course be designed for the transverse stresses along a diameter, and consequently must have a greater thickness. In *Chem. & Met.* for February and March, 1933, (pp. 67-71 and 138-41) are examples of methods of designing flanges.

Weld Defects Shown by Means of Photoelastic Studies

REPRODUCED below are five of a group of photoelastic tests that were presented in a paper given by Everett Chapman, engineering vice president of Lukenweld, Inc., before the American Society of Mechanical Engineers at its last annual meeting. They portray the dangerous concentrations of stress that result from various common faults found in welding. In Fig. 1, *a* shows the effect of incomplete fusion when welding from two sides. Test *b* shows the result of overlapping of weld metal without fusion to the parent metal at the edges. Test *c* represents a weld made from one side of the plate, with incomplete penetration. Fig. 2 shows at the left a proper, and at the right an improper, fillet, and the resulting stress concentrations.

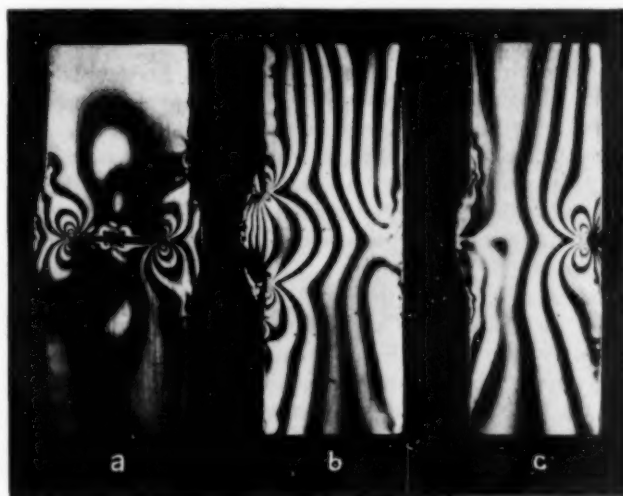


Fig. 1—Photoelastic tests showing effects of common faults in butt welds

Fig. 2—Illustrating effect of proper and improper filleting



A New Continuous Process of OIL EXTRACTION

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THE CONTINUOUS process, recently announced, for extracting oil from soya beans, cotton seed, tung nuts, linseed, castor beans, copra, bone meal, meat scraps, and a wide variety of oil-bearing materials will, it is expected, largely revolutionize the standard and accepted extracting process in these plants. This prediction is made because the extraction equipment operating at the present time, although producing a satisfactory grade of oil, has an inherent disadvantage in its design. It lacks the advantages of continuous operation.

The major existing extraction equipment employs the batch process, in which the extractor is first charged with the material from which the oil is to be extracted, the charging opening is then closed, and a predetermined amount of solvent is pumped into the unit. The solvent in contact with the oil-bearing material takes up part of the oil and is then withdrawn—a step in the process that is commonly known as “one wash.” The original charge is subjected to successive “washes,” until the oil content of the charged material has been reduced to its commercial minimum. Steam is then admitted to the extractor through the small jet-like openings. The solvent vapors and the solvent in the saturated material are removed by the direct steam and by the indirect heat supplied by a steam jacket that surrounds the extractor. The material, now solvent free, is discharged and the process repeated.

The batch principle, aside from the time that is lost in the several steps of the process, permits the solvent to “channel” through the charge in such a manner that imperfect contact is made with the great masses of the oil-bearing material. As a result no definite determination can be made in advance, as to the amount of oil that will be removed and the amount that will remain in the material when it is discharged. For example, in the batch system the oil content of one charge of a material may be reduced with a given number of washes to 2½ per cent while another charge of the same material subjected to the same number of washes in the same unit may be lowered to 1½ per cent or even less.

Many operating officials, accustomed to the efficiency of continuous operation in other plant processes, and appreciating the shortcomings of batch extraction, have

sought to obtain continuous extraction equipment. Many methods have been tried. All of these attempts that have come to the writer's attention have been unsuccessful, including even those systems wherein the material and solvent have been passed, with a screw conveyor, through troughs or pipes set horizontally or at slight incline, and built either in sections, the one discharging into another, or in one continuous line. The greater number, if not all, of these attempted processes have proved unsuccessful because they have failed to take into consideration the necessity of intermingling the solvent freely and thoroughly with the oil-bearing material during the entire period of extraction. In the attempts just described, for instance, and even when the solvent is passed countercurrently with the oil-bearing material either horizontally or slightly inclined, the solvent tends to flow on top of the material and the desired results are not secured.

The continuous process to be described in this article overcomes the disadvantages obtaining both in the batch process and in the attempted continuous processes already mentioned. The equipment has been proved mechanically successful by Bartlett-Snow engineers who have built an experimental unit at the company's plant in Cleveland. It comprises a continuous extraction unit, evaporators, condensers, pumps, recording instruments, tanks, pipes and other accessories.

The extraction unit consists of a steel tank placed vertically, having a cone-shaped bottom section on the center axis of which is built, vertically, a screw conveyor housed in a steam-jacketed section which extends downward to the upper regions of the cone. (See diagram.) The lower end of the screw conveyor shaft is fitted with an agitator. The oil-bearing material, first crushed or cut to desired fineness, is fed into the extractor with a variable-speed screw feeder, a rotary pocket feeder or some other device wherein the material effects an air seal. On entering the extractor the material falls on a revolving plate that automatically distributes it evenly in the annular space between the tank section and the screw conveyor housing.

Units are available in different capacities, the hourly capacity being based on the amount of oil-bearing material that is fed into the extractor. In starting the

process with a 1,000-lb. continuous extractor, 1,000 lb. of oil-bearing material is passed into the extractor at uniform speed during the period of an hour. Meanwhile the solvent, first heated to a temperature that will insure maximum solubility of the oil, is fed in through the solvent inlet, which is located within and near the top of the screw conveyor housing. The heated solvent passes downward through the screw conveyor, past the end of the housing, and rises countercurrently with the oil-bearing material, to be withdrawn through screens and piped to the distilling unit.

At the end of an hour the screw conveyor is started and the first of the solvent is withdrawn. The oil-bearing material is drawn upward by the vertical screw conveyor, the same amount of new oil-bearing material is being received into the extractor and the desired amount of solvent is being passed countercurrently with the material. Advantages of this continuous process are easily seen. All of the oil-bearing material is subjected to a thorough mixture with the heated solvent for the required period of time. The equipment permits fresh solvent offering greatest capacity to take up oil to be passed over material of lowest oil-bearing value first, thus reducing its oil content still further at a time when the solvent has greatest absorption value. As the solvent, rising toward the screen, becomes more and more saturated, it is brought into continuous contact with fresh material from which oil can be extracted more easily. The greatest amount of oil is extracted with the least amount of solvent. The solvent has no opportunity to channel. The feeding arrangement insures against the loss of solvent vapors.

The solvent and oil mixture is pumped from the extractor unit through a closed-type steam heater into the fractionating column of the distilling unit. The heated solvent flashes in this column. The vapors pass upward into the rectifying section, the unflashed portion passes downward through the stripper plates where it is stripped countercurrently with the ascending steam.

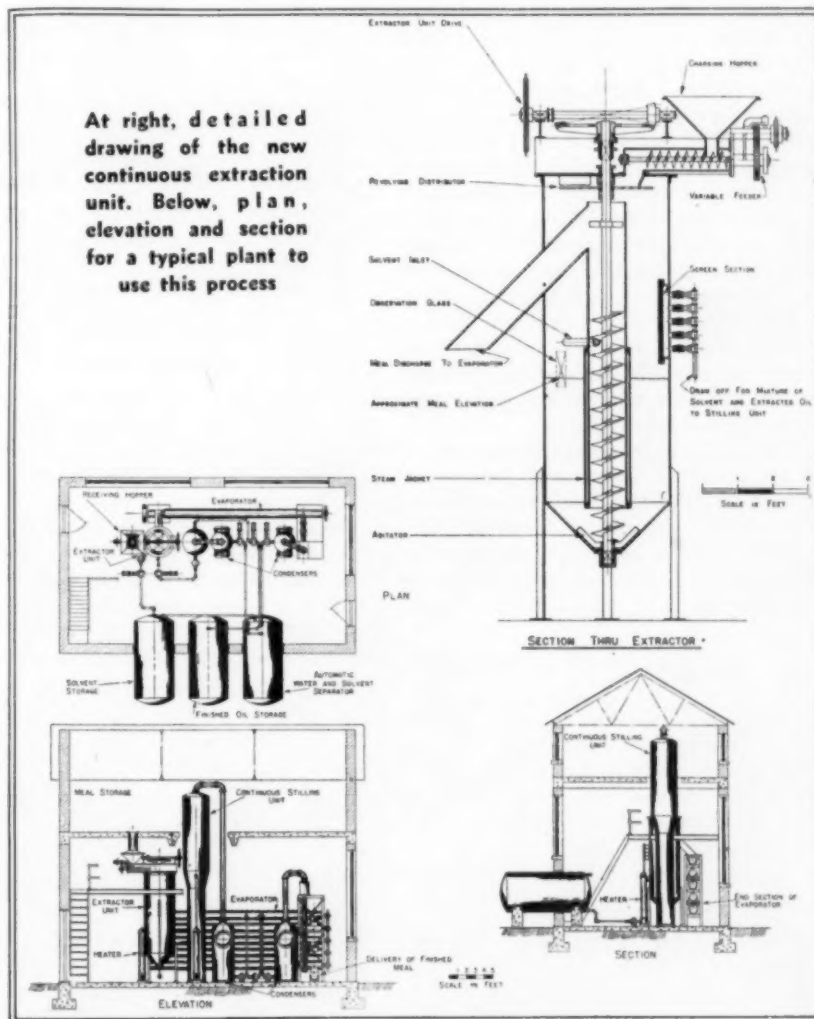
Reheaters are provided to vaporize the unflashed solvent and to insure the production of an oil that is solvent free. It is to be noted that the oil and solvent vapors are passing countercurrently and are in constant motion, thus producing an oil solvent free at low temperatures and in the shortest time possible, conditions that are most desirable for the recovery of high-grade oil.

Oil, free from solvent, is recovered from the base of the fractionating column and pumped to storage tanks. The solvent vapors are passed through a condenser, pumped to an automatic solvent and water separating tank, from which the water is passed into sewers, the solvent returned to storage for re-use. The equipment is shown in the accompanying drawings.

The meal, saturated with solvent, but free of oil since it was last passed through

fresh solvent at the top of the screw conveyor, is chuted to an evaporator where the solvent and solvent vapors are removed. The evaporator consists of a series of steam jacketed pipes fitted with cut flight screw conveyors, ample space being allowed for the solvent vapors to work their way upward. The meal is discharged from a pipe into the receiving hopper of a similar pipe, until it is finally passed out free of solvent and solvent vapor, ready for storage. Solvent vapors collected in the extraction unit and in the steam-jacketed evaporators are passed through a closed-type condenser, to the automatic water-solvent separator already described, and then into solvent storage for re-use.

This new continuous extraction unit is adapted for wide use with a variety of different products and materials. The first or original cost is about two-thirds that of the batch equipment previously used, and the operating costs for labor, power, steam, solvent loss, etc., are claimed to be much lower. A high percentage of oil recovery is obtained, thus giving greater output per dollar of invested capital and operating costs. The equipment operates at relatively low temperatures. In short, the new process offers all of the economies of continuous operation and should therefore be of interest to chemical engineers in the oil and other industries in which batch extraction processes are used.



BOOKSHELF

Industrial Capacity

AMERICA'S CAPACITY TO PRODUCE. By *Edwin G. Nourse and Associates*. Publication No. 55, the Brookings Institution, Washington, D. C. 610 pages. Price, \$3.50.

Reviewed by *R. S. McBride*

PROFIT is still the objective and life blood of industry, notwithstanding alleged Brain Trust opinion to the contrary. And industrial profit depends on the effective use of investment, generally requiring a high ratio of operating rate to potential capacity. Hence every process industry executive is, whether he knows it or not, seriously concerned with the problems discussed in this volume.

Many chemical engineers will not accept one hundred per cent the findings or opinions expressed. However, the majority of conclusions appear sound from the standpoint of technologic economics, just as they surely are sound from the standpoint of pure industrial economics. The authors are outstanding in this latter field. Their judgment, therefore, should be acceptable, generally will be.

But more important than mere economic finding is the economic method of analysis of industrial situations which this book presents. The technique used is sound and valuable. The study of that technique should benefit every process industry executive and engineer who is concerned at all with planning. Even though many of the chemical process industries find no reference to themselves in the work, the studies are nonetheless valuable when adapted to problems of our industries.

The book can be cordially commended as a useful tool for process industry of all types. Furthermore, it will be a reservoir of useful facts against which to judge special situations either of industry-wide significance or of individual company trend.

New Technology

CHEMISCHE TECHNOLOGIE DER NEUZEIT, 2nd Edition, Vol. II, Part 1. By *Otto Dammer*. Edited by *Frantz Peters* and *Hermann Grossmann*. Published by *Ferdinand Enke*, Stuttgart. 876 pages. Price, 75 Rm.

Reviewed by *J. S. Streicher*

CONTRIBUTIONS to the second of the five volumes constituting the new *Dammer* are made by *von Schwartz*, writing on metals and alloys; *von Hagen*, on protective metallic coatings; and

Peters, dealing with ore dressing. New developments in these fields are discussed in detail in these three sections; however, many old concepts and methods, inherited from the older edition, have been retained. The newest developments are excellently characterized only as far as the authors are specialists; other data are presented as they are generally known from textbooks, without special regard to the newer developments found in the literature.

Generally speaking this part of the book still gives many facts at such length and in such diversity that the book has the character of a handbook; the practical man will find many data to solve his operating problems; appended to each chapter he will also find extensive bibliographies permitting him to trace the scientific background of each development.

Chemical Reviews

ANNUAL SURVEY OF AMERICAN CHEMISTRY. By *Clarence J. West*. Vol. VIII. Published by the Chemical Catalog Co., Inc., New York. 403 pages. Price, \$4.50.

ANNUAL REPORTS ON THE PROGRESS OF CHEMISTRY. By *Clarence Smith*. Vol. XXX. Published by *Richard Clay and Sons*, Bungay, Suffolk. 462 pages. Price, \$3.

REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY. By *T. F. Burton*. Vol. XVIII. Published by the Society of Chemical Industry, London. 777 pages. Price, 12 shillings, 6 pence.

Reviewed by *D. B. Keyes*

AGAIN Dr. C. J. West is to be congratulated on the publication of Volume VIII of the Annual Survey of American Chemistry. In spite of a limited budget the Survey is well done. It is both thorough and accurate. Dr. F. W. Willard, Chairman of the Division of Chemistry and Chemical Technology of the National Research Council, states in the Foreword that this survey covers twenty-five topics, twelve of which are confined to the field of pure science. The rotation of topics is continued. Ten of the topics are scheduled for annual treatment. One can especially congratulate Dr. West on his selection of authors, and compliment the authors on the immense number of references they have considered.

The Annual Reports on the Progress of Chemistry, Volume XXX, issued by the Chemical Society of London has recently been published and the high standard of former volumes is maintained. This report covers not only

British work but the work in other countries. A large share of the material is in the organic field. It can be said that these reports are very popular with the chemists in the United States. The critical nature of these reviews is especially pleasing.

No annual survey better covers the field of Applied Chemistry than does the Annual Reports of the Society of Chemical Industry (London). It is true that some specific topics are covered far more thoroughly than others but the book contains an enormous amount of material and gives a very fair picture of the industrial chemical development during the period.

These three annuals would be valuable additions to the library of every chemist and chemical engineer.

Colloids

THE LYOPHILIC COLLOIDS (THEIR THEORY AND PRACTICE). By *Martin H. Fischer* and *Marian O. Hooker*. 246 pages, 84 figures and plates, 83 tables. Published by *Charles C. Thomas*, Springfield, Ill. Price, \$4.50. Reviewed by *Frederick E. Schmitt, Jr.*

THIS BOOK is not, as one might infer from the title, a treatise on the general theory and practice of the lyophilic, or "gel," type of colloid. It is rather an exposition of the authors' own view of the subject at hand, developed particularly as a tool to inquire into the nature of living matter, and it ignores all classes of phenomena not germane to their definite purposes of proof and application. In the course of their extended researches into the structure of protoplasm, the authors have encountered many extensions of physicochemical theory into biochemistry; which extensions they have found unsuccessful. As a result, they are inclined to look with slight scorn on all pure chemistry or physical chemistry when applied to colloids.

The thesis which the authors seek to prove is, briefly, that a colloidal system such as sodium stearate-water is identical with a partially mutually-soluble system such as phenol-water, the gel form of the soap being a solution of water-in-soap and identical with the phenol phase, representing water dissolved in phenol, of a phenol-water system. This they adduce from similarities in electrical resistance and volume curves when plotted against composition, concentration, and temperature of the water phase. The authors have overlooked the fact that the colloid-like behavior of water-in-phenol, water-in-

quinolin, and their other examples is not traceable directly to partial mutual solubility, but to other properties of the system, with the result that they have been enabled to build a splendid case for their theory. Since the theory was devised to explain protoplasmic behavior, it is not surprising that in this branch the results are excellent. The chemical applications deduced from their theory would be very useful, if new. There are, however, other and more tractable tools for handling the same problems, though none are in common use.

A word is due the publisher in commendation for the mechanical excellence of the book. In design, in typography, in binding, it is far above the usual scientific book, and is indeed a pleasure to read. The authors, too, deserve praise for the perfection of illustration, each plate being so well photographed that the reader may partake at first hand in the experimental results.

Gas Directory

BROWN'S DIRECTORY OF AMERICAN GAS COMPANIES. Compiled and published by the staff of Robbins Publishing Co., New York City. 1934 edition. 625 pages. Price, \$15.

THIS IS the latest edition of the series of directories which portray constantly changing conditions among companies selling natural gas or manufactured gas, and holding companies interested in gas. Those having business with any phase of the city gas industry will find this an excellent guide to operations, personnel, and corporate relationships.

A.G.A. PROCEEDINGS. The 15th Annual Convention and International Gas Conference at Chicago, Ill. 1933. Published by American Gas Association, 420 Lexington Ave., New York City. 940 pages. Price, Members: \$3.00; Non-members, \$7.00.

THIS IS the annual résumé of the technical proceedings which includes final printing of extended committee reports, summaries of technical investigations, and convention papers and discussion. An essential volume for any library which intends to cover either manufactured gas or natural gas.

INVESTIGATIONS OF FUELS AND FUEL TESTING. By staff of Fuel Research Laboratories, Canadian Department of Mines. Document No. 737, Mines Branch. Obtainable from Ottawa office.

SUMMARIZING fuel investigations for 1932, this report presents detailed results and general conclusions in nine papers, available only in this assembled form. The separate papers relate to anthracite and coke analyses; the F.R.L.

method for rating the grindability of coal; method for predicting physical properties of byproduct coke from test on coal; changes in sulphur form in coal during weathering; classification of coal on a mineral-free basis; hydrogenation and cracking tests of low-temperature coal tar; apparatus for continuous hydrogenation of tars, bitumens, and powdered coals suspended in tar; natural gas and gasoline byproducts of Alberta; Dominion gasolines sold in 1932.

Heat Transmission

INDUSTRIAL HEAT TRANSFER. By *Alfred Schack, Hans Goldschmidt and Everett Partridge.* Published by John Wiley & Sons, Inc., New York. 371 pages. Price, \$5.

THIS BOOK is a translation of Dr. Schack's "Der Industrielle Wärmeübergang," in which particular care has evidently been taken not only to produce an idiomatic, yet faithful, rendition, but at the same time to make the work of greatest possible value. To this end, all metric units have been replaced with English. In addition, the more important equations have been high-spotted and especial care has been taken to provide convenient approximate equations wherever they will prove more useful than the more complicated theoretical equations which have been derived. At every point the needs of the practical user have obviously been kept in mind.

The treatment is logical, passing from a study of the three methods of heat transference (conduction, convection and radiation) to a consideration of transfer in heat exchangers and in industrial furnaces. The theory is concluded by a section on determining optimum relations between heat transmission and pressure drop, and this is followed by a chapter containing numerous numerical examples, demonstrating the use of the material already cited.

THE ENGINE INDICATOR. Its Design, Theory and Special Application. By *K. J. DeJuhasz.* Published by Instruments Publishing Co., New York. 235 pages. Price, \$3.75 (including year's subscription to "Instruments").

ANY ENGINEER who has occasion to measure variable pressures, whether they be in steam engines, internal combustion engines, pumps, compressors, ordnance, or elsewhere, will be interested to discover from Professor DeJuhasz's authoritative volume what progress has been made with the engine indicator in recent years. The book is thoroughly illustrated and provided with a well chosen bibliography. Particularly excellent treatment is accorded the newer uses of indicators.

Rayon Handbook

RAYON AND SYNTHETIC YARN HANDBOOK. First Edition. Edited and compiled by *E. W. K. Schwarz* and *H. R. Mauersberger.* Published by Rayon Publishing Co., New York. 420 pages plus advertising. Price, \$3.

ALTHOUGH this handbook was aimed primarily at the needs of those in the textile industry, concerned with the production of rayon fabrics, it contains much that should be useful to chemists and engineers engaged in rayon manufacture. For these latter, an excellent chapter on the industry's statistical background, together with other chapters on chemical and physical properties, denier, dyeing, analysis and testing, world lists of rayon producers, and bibliography, are likely to prove of greatest value. Other chapters on the textile phases of woven, knit and staple goods, printing and finishing will be of secondary interest. For the laymen are brief chapters on history and an outline of the major processes. A complete list of brand and trade names applying to the industry is also presented.

MINERS AND MANAGEMENT. By *Mary Van Kleeck.* Published by Russell Sage Foundation, New York. 391 pages. Price, \$2.

STUDY of the basic principles in the relation between labor and management takes on increased importance as the world emerges from its present distress. The subject of this investigation is a collective agreement between miners and management, with principles and procedure in the relation between United Mine Workers of America and Rocky Mountain Fuel Co. This company has undertaken, with the cooperation of its employees, to stabilize production, markets, and employment, to establish industrial justice, to substitute reason for violence, confidence for misunderstanding, faith and integrity for dishonest practice. This significant venture has been competently described by the author, and conclusions are drawn from a perspective of fifteen years' study of various industrial experiments.

Nitrogen in Biochemistry

AN INTRODUCTION TO THE BIOCHEMISTRY OF NITROGEN CONSERVATION. By *Gilbert J. Fowler.* Longmans-Green & Co., New York. 280 pages. Price, \$4.50.

ALTHOUGH the modern methods of nitrogen fixation have eliminated the possibilities of a nitrogen famine, the problem of nitrogen conservation cannot be said to be entirely disposed of, since this author believes that mineral nitrogen, such as ammonium compounds and

nitrites, or amino compounds, such as cyanamid or urea, are not fully adequate to meet the needs of the plants. He cites modern experiments to show that to obtain increased yields and crops of highest nutritious value, organic manure is essential. The author, whose scientific and professional life work has been devoted to the study of nitrogen conservation, has in the present volume consolidated the contents of a series of lectures delivered on this subject at Patna University, India. Among the important subjects discussed in the book may be mentioned sources of organic nitrogen, nitrification and ammonia formation, nitrogen fixation, decomposition of organic matter, refuse disposal, chemistry of sewage purification, and assimilation of nitrogen by plants.

New Chemical Books

THE DISCOVERY OF THE ELEMENTS. Second Revised Edition. By *Mary Elvira Weeks*. Mack Printing Co., Easton, Pa. 363 pages. Price, \$2.

ALTHOUGH the story of the discovery of most of the elements may be found somewhere or other in the chemical literature, a connected narrative of these discoveries has been lacking. This volume has been prepared from a series of articles by the author in *Journal of Chemical Education*. It is a fitting tribute to the great natural scientists to whom the world owes so much of its material progress, and the acquaintance with this fascinating subject should furnish inspiration to all students of chemistry.

THE CHEMISTRY OF SOLIDS. By *Cecil H. Desch*. Cornell University Press, Ithaca, N. Y. 213 pages. Price, \$2.50.

IN THIS VOLUME the author presents the substance of a series of lectures which he gave three years ago at Cornell University, as George Fisher Baker non-resident lecturer in chemistry. Although most of the topics are taken from the field of metallography, the study of alloys should also throw light on many problems in the non-metallic systems. Lack of space has made it necessary to deal only briefly with corrosion, and to omit entirely the important subject of surface catalysis.

FORTSCHRITTE IN DER ANORGANISCH-CHEMISCHEN INDUSTRIE, Vol. IV, Part I. By *Adolf Bräuer* and *J. D'Ans*. Julius Springer, Berlin, 892 pages. Price, 128 Rm.

A REVIEW of the progress in inorganic chemistry, based on German chemical patents for the period 1928-32. The present volume deals with hydrogen, the halogen group, oxygen, and

sulphur. Two additional volumes scheduled to appear this year will complete the five-year period, another volume will cover 1933 and 1934, whereupon each year will be treated separately, with comprehensive summaries of the individual groups every five years.

RECENT ADVANCES IN PHYSICAL CHEMISTRY. Second Edition. By *Samuel Glasstone*. P. Blakiston's Sons & Co., Philadelphia. 498 pages. Price, \$4.

ALTHOUGH the first edition appeared only two years ago it has been necessary to revise every chapter to include important new material. Among new subjects treated are wave mechanism and its application to problems of valency and the calculation of energy of activation; nuclear disintegration, the neutron, and the positive electron; atomic reactions; potential energy curves; the kinetics of photochemical reactions; activated and discontinuous adsorption; surface potentials; and the mobility of surface molecules.

CHEMICAL PATENT INDEX (U. S. 1915-24). Vol. V. By *Edward Chauncey Worden*. The Chemical Catalog Co., Inc., New York. 1,091 pages. Price, \$25.

IN THIS FIFTH and concluding volume are included the United States chemical patents for the ten-year period 1915-24, covering the subjects under the letters S to Z inclusive, and containing a total of 170,800 patent citations. The system of classification is the same as used in the preceding volumes. In addition to the patents for chemical processes and products, the uses of the products are also included in the index. Much credit is due Dr. Worden and his staff for this excellent contribution to the chemical reference literature.

A COMPREHENSIVE TREATISE ON INORGANIC AND THEORETICAL CHEMISTRY. Vol. XIII. By *J. W. Mellor*. Longmans, Green & Co., New York. 948 pages. Price, \$20.

WITH THIS VOLUME Dr. Mellor's excellent handbook is approaching its completion. The present volume finishes the chapter on iron.

CHEMICAL GUIDE - BOOK. Tenth Edition. Published by Chemical Markets, New York. 695 pages.

A CATALOG of leading chemical firms in the United States, and a listing of the products manufactured. In this edition 96 pages with 246 new chemicals and 402 new synonyms have been added.

THORPE'S DICTIONARY OF APPLIED CHEMISTRY, Supplement, Vol. I. By *J. F. Thorpe* and *M. A. Whiteley*. Longmans, Green & Co., New York. 680 pages. Price, \$25.

SINCE the appearance of the last volume of Thorpe's about seven years ago, the science of chemistry and its industrial applications have made such rapid advances that it has become necessary to bring the existing edition up to date, by the preparation of two supplement volumes, of which the first covers the subject matter up to and including letter M. In completing these it has been assumed that the reader in his study will have access to the main work. The usual dictionary style has been dropped in many instances and the subject matter has been treated in monographs by contributors eminent in their respective fields, giving a concise account of the present status of the knowledge in that particular section.

FORTSCHRITTE DES CHEMISCHEN APPARATEWESENS, Vol. I. Edited by *Adolf Bräuer* and *Josef Reistötter*. Akademische Verlagsgesellschaft, Leipzig. 176 pages. Price, 28 Rm.

A REVIEW of the progress made in the construction of chemical apparatus and equipment, based on German patent literature, and prepared by experts in the various fields with the assistance of Dechema. Electric furnaces is the subject treated in the first volume.

Metals and Alloys

ARSENICAL AND ARGENTIFEROUS COPPER. By *J. L. Gregg*. The Chemical Catalog Co., New York. 189 pages. Price, \$4.

COPPER produced in the Lake Superior region has always enjoyed an enviable reputation. A small content of arsenic and silver is frequently present in this copper, although, contrary to common belief, this is not the case with all Lake copper. For many purposes small quantities of these impurities offer definite advantages. The main part of this book is devoted to a study of the physical properties of this copper and alloys made therefrom, such as electrical and thermal conductivity, mechanical properties at normal and at elevated temperatures, and the resistance to various corrosive agents. Much new material is presented which should prove of great value to the metallurgist and the manufacturer.

PRAKTISCHE METALLKUNDE, Vol. II. By *Georg Sachs*. Julius Springer, Berlin. 238 pages. Price, 18.50 Rm.

IN THE SECOND VOLUME the author presents a systematic treatment of the phenomena connected with the

shaping of metals. A brief review of the most important theoretical considerations involved, and chapters on hot and cold forming and heat treatment comprise the first section of the book. The second section is devoted to a discussion of internal stresses in deformed metals, while the general technology treated in the third section contains chapters on forging, pressing, stamping, rolling, and drawing.

ALLGEMEINE METALLKUNDE. By E. Piwowarsky. Verlag Gebrüder Borntraeger, Berlin. 248 pages. Price, 14.40 Rm.

A TEXTBOOK in physical metallurgy and metallography, written principally for the advanced student and the practising metallurgist. In addition to a discussion of important ternary and binary systems it deals with principles of alloying technique, properties of melts, solidification and crystallization phenomena, solubility of gases in metals and alloys, heat-treatment, mechanical and physical properties of metals and alloys, and corrosion.

Food and Drink

PRINCIPLES OF FOOD PRESERVATION. By T. N. Morris, University of Cambridge, and Department of Scientific and Industrial Research, Low Temperature Research Station. Published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York. 239 pages. Price, \$5.

UNIT OPERATIONS in food processing under discussion here are preserving, canning, and drying. In the preparation of this sixth volume of a series of monographs on applied chemistry under the editorship of E. Howard Tripp, the author draws upon nine years of research and factory experience in the fruit preserving industry and five years' research in fruit canning. Rapid strides made by England during the past two years in building up a fruit canning industry could hardly have been possible without a technical understanding and application of the principles discussed by Morris.

MANUFACTURE OF WHISKEY, BRANDY AND CORDIALS. By Irving Hirsch. Published by Sherman Engineering Co., Newark, N. J. 133 pages. Price, \$10.

A COMPILATION of methods for processing high grade malted, fermented and distilled beverages, with description of modern layouts and equipment used in the manufacture. Explanatory definitions of the various types of beverages, label regulations, and government practices relative to their marketing have also been included.

ENGLISH-GERMAN DICTIONARY FOR METALLURGISTS. Part II. By Henry Freeman. Otto Spamer Verlag G.m.b.H. Leipzig, Germany. 347 pages. Price, 25 Rm.

A THOROUGH STUDY of German, English, and American periodicals has been made in the preparation of this dictionary. In addition more than a thousand technical catalogs have been

consulted, from which valuable word material has been extracted. Terms from construction engineering, ferrous and non-ferrous metallurgy, metal fabrication, welding, foundry operation, laboratory installations, technique of measurement, microscopy, and radiography have been included. Comprehensive conversion tables, alphabetically arranged, and a list of symbols and abbreviations have also been prepared.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Some Physical Properties and Characteristics of Fuse, by N. A. Tolch and J. E. Tiffany. Bureau of Mines Report of Investigations 3235; mimeographed.

The Industrial Utility of Public Water Supplies in the United States, 1932, by W. D. Collins and others. Geological Survey Water-Supply Paper 658; 15 cents. Information relating to the chemical characteristics of water supplies.

Silicosis. Public Health Service, Reprint 1626; 5 cents. Discusses prevalence, preventive measures, and stages of this dust disease.

Underfeed Combustion, Effect of Preheat, and Distribution of Ash in Fuel Beds, by P. Nicholls. Bureau of Mines, Bulletin 378; 10 cents.

Animal and Vegetable Fats and Oils. Bureau of the Census, unnumbered pamphlet; 5 cents. Gives production, consumption, imports, exports and stocks by quarters, calendar years 1929 to 1933.

Report on the Agricultural Experiment Stations, 1933, by J. T. Jardine and W. H. Beal. Department of Agriculture, unnumbered pamphlet; 10 cents.

List of Publications of the Department of Commerce, July 1, 1934 edition.

Electrical Industry Census, 1932—guide to potential markets for chemicals among concerns dealing in: Electric Railways and Motor-Bus Operations of Affiliates, 10 cents; Telephones and Telegraphs, 5 cents; Central Electric Light and Power Stations, 10 cents.

Wood Preserving—Federal Specifications for: Wood-Preservative, Creosote (for) Brush and Spray Treatment, TT-W-561a; Wood-Preservative, Preservative Treatment, TT-W-571a; 5 cents each.

Preservation of Newspaper Records. Bureau of Standards, Miscellaneous Publication 145; 5 cents. A study to fix the period of use of impermanent newspaper, and to determine preservative treatments.

Synthetic Camphor. U. S. Tariff Commission unnumbered document; mimeographed. Investigation of the relation of production to consumption during six-month period ended June 17, 1934.

Canned Fishery Products and Byproducts of the United States and Alaska, 1933. Bureau of Fisheries, Statistical Bulletin 1086; mimeographed.

Leather Trade. Bureau of Foreign and Domestic Commerce Special Circulars on: United States Exports of Leather, by David Longanecker, No. 1233; United States Imports and Exports of Leather Manufactures, 1921-1933, by E. G. Holt, No. 1234; mimeographed. Copies available from the Bureau only; 10 cents each.

Review of the Petroleum Industry in the United States, April, 1934, by Hale B. Soyester. Geological Survey Circular 11; mimeographed.

World Chemical Developments in 1933 and Early 1934, by C. C. Concannon and A. H. Swift. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin 818; 10 cents.

Asbestos—Domestic and Foreign Deposits, by Oliver Bowles. Bureau of Mines Information Circular 6790; mimeographed.

Amber, by Alice V. Petar. Bureau of Mines Information Circular 6789; mimeographed. Discusses the properties, uses,

occurrence, mining and preparation, production, imports and exports.

Helium, by Andrew Stewart. Bureau of Mines Information Circular 6745; mimeographed. Information concerning its properties, derivation, methods of production, and uses.

An Apparatus and Method for the Determination of Helium in Natural Gas, by C. C. Anderson. Bureau of Mines Information Circular 6796; mimeographed.

A Thermal Conductivity Apparatus for Continuous Determination of the Helium Content of Natural Gas, by Allen S. Smith. Bureau of Mines Report of Investigations 3250; mimeographed.

The Occurrence of Gases in Coals, by R. F. Selden. Bureau of Mines Report of Investigations 3233; mimeographed.

Ore-Dressing Bibliography, 1931-32, by T. H. Miller and R. L. Kidd. Bureau of Mines Information Circular 6784; mimeographed.

Summary of Ore-Mining Cost Data, by Chas. F. Jackson. Bureau of Mines Information Circular 6785; mimeographed.

Ore-Dressing Studies. Bureau of Mines Report of Investigations 3239; mimeographed. Contains articles on grinding tests for easy interpretation of results, and flotation and depression of nonsulphides, calcite, silica and silicates, fluorspar, barite, apatite, and tungsten minerals.

Size Preparation of Iron Ores and Desulphurization Studies. Bureau of Mines Report of Investigations 3240; mimeographed.

Slag Viscosity, by G. H. Herty, Jr., and others. Bureau of Mines Report of Investigations 3232; mimeographed. Temperature-viscosity measurement in the systems CaO-SiO₂ and CaO-SiO₂-CaF₂.

Detailed Statistical Microscopic Analyses of the Ore and Mill Products of the Silver King Flotation Concentrator, Park City, Utah, by R. E. Head and others. Bureau of Mines Report of Investigations 3236; mimeographed.

Chemical Method for Removing Mud Sheaths in Oil Wells, by H. C. Miller and G. B. Shea. Bureau of Mines Report of Investigations 3249; mimeographed.

Formulas for Designing Natural-Gas Pipe-Line Systems Consisting of Parallel Lines, by T. W. Johnson and W. B. Berwald. Bureau of Mines Report of Investigations 3241; mimeographed.

Production Statistics From 1933 Census of Manufactures in preliminary mimeographed form for: Anhydrous sodium sulphate, Glauber's salt; Chewing and smoking tobacco, and snuff; Cane-sugar refining; Cane sugar; Beet sugar; Corn syrup, corn sugar, corn oil, and starch; Soap; Tin plate and terneplate; Pig iron and ferro-alloys; Aluminum products; Tin and other foils, not including gold foils.

Mineral Production Statistics for 1933—preliminary mimeographed statements from Bureau of Mines on: Lead; Salt, bromine, calcium chloride, and iodine; Arsenic; Phosphate rock; Slate; Talc and ground soapstone; Barite and barium; Precious and semiprecious stones; Mica; Platinum and allied metals; Byproduct sulphuric acid at copper and zinc plants; Iron and steel; Manganese ore; Abrasive materials; Magnesium; Aluminum salts; Mercury; Natural sodium compounds; Special cements.

PLANT NOTEBOOK

NEW CHART FOR CONVERTING GAS VOLUMES TO STANDARD CONDITIONS

By Temple C. Patton
Worcester Academy
Worcester, Mass.

TABLES have been compiled giving correction factors which may be used in converting gas volumes at various temperatures and pressures (saturated with aqueous vapor) to standard conditions. Standard conditions, for most gas work, have been generally established at 30 in. of mercury for the total gas pressure and 60 deg. F. for the gas temperature—the

gas being saturated with water vapor. This widely accepted criterion has been taken as the basis for the following alignment chart, which offers a graphical solution in obtaining the proper correction factor to be applied to a volume of gas for conversion to standard conditions.

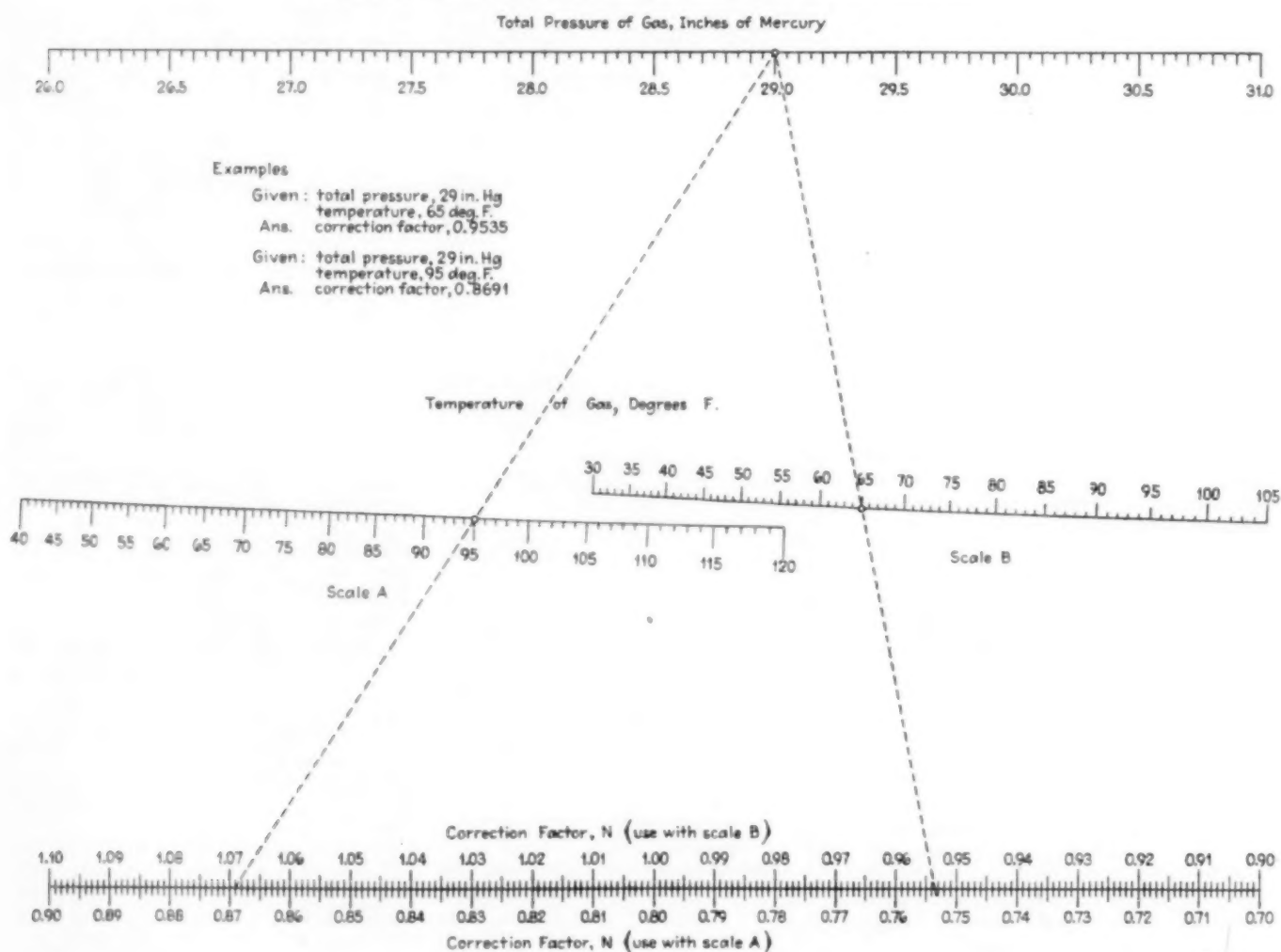
The use of the chart has an advantage over the use of a table in that visual

interpolation along a continuous graduated scale is much simpler than the double arithmetical interpolation which may be necessary when using tabulated values which increase by increments. Furthermore, the chart, if used with care, will give a greater accuracy than can be obtained from any known available tables.

The range of the chart can be seen to cover total pressures extending from 26 to 31 in. of mercury, and temperatures ranging from 30 to 120 deg. F. Most conditions will fall within these extremes.

The formula used in constructing the chart (from "Combustion," p. 26, 1932 ed., published by American Gas Association) is given below.

Alignment chart for correcting fuel gas mixtures to standard conditions



Let V_o = volume as read with meter under operating conditions, saturated with water vapor.

V_s = volume at standard conditions of 60 deg. F., 30 in. Hg, saturated with water vapor.

H = absolute pressure of the gas in inches of mercury.

A = water vapor pressure at t deg. F.

t = temperature of the gas in degrees F.

Then

$$V_s = V_o \times 17.626 \times \frac{H - A}{459.6 + t}$$

To obtain the proper correction factor from the chart, corresponding to any set of conditions, first locate and mark the observed gas pressure and temperature values on their respective scales, as noted on the chart. Then connect these two values by a straight line and extend this straight line to intersect the correction factor scale. This gives the correction factor value to be used and corresponds to the values of temperature and pressure originally entered into the problem. Let this correction factor value be represented by N . Then $V_s = V_o \times N$.

That is, the observed volume under operating conditions is multiplied by the correction factor to obtain the volume corrected to standard conditions of 60 deg. F., 30 in. Hg, and saturated with water vapor. Note that the total or absolute pressure = corrected barometer reading (inches Hg) + gage pressure (inches water $\times 0.0735$).

Two typical examples are worked through on the chart to illustrate the method. It will be found that only one of the temperature scales can be used for a given problem, as with the other the line will extend off the chart. Each temperature scale must be used only with its correct correction factor scale, as noted on the chart.

In determining what accuracy the original formula warranted in the final result, the available literature was consulted to check whether the assumption made of variation of gas volume directly with temperature and reciprocal pressure was sufficiently representative of actual conditions to merit a precision of 0.1 per cent in the correction factor.

The Beattie-Bridgeman equation of state (*Zeits. f. Physik*, 62, 1930, 95) was selected as fully adequate to show the deviation of actual gases and their mixtures from ideal conditions. A coal gas of the following percentage volume composition was chosen as a typical gas of the type which is met in commercial gas work.

Gas	Volume Per Cent	Gas	Volume Per Cent
CO ₂	2.2	H ₂	50.0
O ₂	0.6	C ₂ H ₄	3.0
N ₂	8.0	C ₂ H ₆	28.2
CO	8.0		

Values for the constants to be used in the Beattie-Bridgeman equation were derived from the constants of the individual gases composing the mixture. For the particular gas noted above it was shown that for small pressure changes ranging from 26 to 31 in. of mercury and through a small temperature range from 32 to 120 deg. F., the results based on the assumptions made deviated by less than 0.05 per cent from actual conditions. This is in contrast to a deviation of around 0.2 per cent for pure CO₂ through this same range.

From the above it appears that no sweeping statement can be made as to the accuracy of the correction factor now calculated for commercial gas work in which the nature of gas is disregarded. It happens that for the coal gas of the above given composition the accuracy is good to 0.05 per cent, but other gases might conceivably deviate by 0.2 per cent or more. However, the precision of the observed experimental data such as temperature, volume and pressure measurements is seldom better than 0.2 per cent so that for most practical purposes the correction factor, as now given, is as good as the data entered into the problem.

Quick Repair for Sulphuric Acid Lines

By C. T. Weiler
Philadelphia, Pa.

INDUSTRIES that handle sulphuric acid are occasionally troubled with leaks in acid lines. Since many processes operate on a 24-hour basis, such leaks are apt to develop when the mechanics are off duty, making it necessary either to call in the plant repairman, or for the operator to do a temporary job with clamps—which should always be kept on hand.

When clamps are used it is general practice to use a soft rubber patch or one of asbestos or soft lead, or a rope asbestos patch treated with sodium silicate. The type of patch to use depends on the concentration of acid handled and the life of the patch is limited, especially when the line is used to deliver different concentrations.

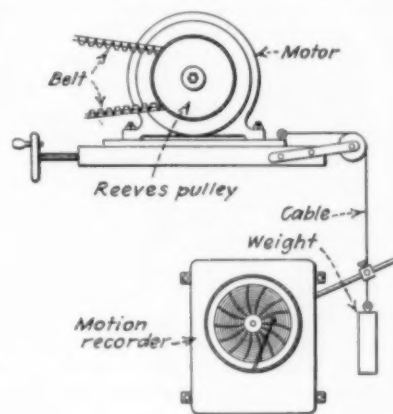
The writer has found that a patch made in the following manner makes a permanent job that is ready to use in 15 minutes after it is completed, and yet employs ordinary temporary pipe clamps. In the plant in which this was used both 20 per cent oleum and oil of vitriol are pumped 3,000 ft. through a 3-in. welded steel line to wharf storage tanks. When a leak developed a 6-in. length of 4-in. pipe was halved lengthwise. The two halves were internally

coated to a depth of $\frac{3}{8}$ in. with Penchlor acidproof cement of the consistency of putty. They were then placed around the leaky section and secured with $\frac{1}{4} \times 1\frac{1}{2}$ -in. clamps. The line was placed in service in a quarter hour and has since handled 2,000 tons of concentrated acid without leakage.

Recording Machine Speed

By J. M. Wilcox
Longview Fibre Co.
Longview, Wash.

IT IS often desirable to keep a record of machine speed when a variable-speed drive is used. A simple and practical method is to use a motion recorder. The diagram shows a Reeves drive for a filter drum. The motor is mounted on a sliding platform and the motion recorder shows the position of the motor at any time. The chart on



Operation recorder used to record machine speed

the motion recorder may be calibrated directly in r.p.m. of the drum. Using other types of variable speed drive, the motion recorder may be linked to any part of the speed adjustment apparatus that moves with a direct relation to the r.p.m. of the driven part.

Tannic Acid for Burns

Recently wide publicity has been given, through magazine articles and through the exhibit of the Henry Ford Hospital, of Detroit, at the Chicago World's Fair, to the Davidson tannic acid treatment for burns of all kinds. This new method is now extensively used in hospitals and has greatly decreased mortality, pain, shock and the formation of scars. It is equally suitable for first aid, the treatment consisting in the application of bandages soaked in fresh 5 per cent tannic acid solution. This is continued for about 20 hours. A tanning of the injured skin takes place, preventing the absorption of skin toxins.

NEW EQUIPMENT

Improved Recovery Plant

Combustion Engineering Co., 200 Madison Ave., New York City, working in association with the D. J. Murray Mfg. Co., Wausau, Wis., has recently introduced the improved Murray-Waern system of chemical recovery for soda and sulphate pulp mills. This system, shown in the accompanying drawing, is a complete chemical and waste-heat recovery unit, employing a water-cooled smelter, rotary dryer, waste-heat boiler, air preheater and disk evaporator. It is claimed for the unit that an efficiency of over 55 per cent is obtained in the recovery of the total heat in the black liquor, and that this heat is all recovered in the form of steam at the desired plant pressure.

Improvements incorporated in the new set-up include replacement of refractory construction in the smelter by water-cooled furnace walls and the use of a water-cooled lip on the smelter end of the rotary dryer, permitting the latter to project directly into the smelter. This construction eliminates manual transfer, and excludes excess air.

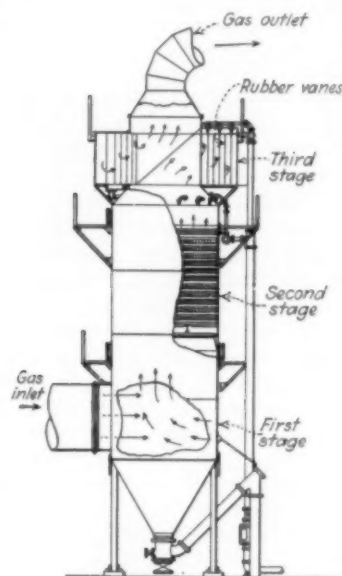
Operation of the system is as follows: After passing through a multiple-effect evaporator, the black liquor enters the disk evaporator from which it is pumped into the rotary dryer through a water-cooled pump. Here the liquor is dried and the residue delivered directly to the smelter, in which remaining combustible

material not consumed in the dryer is burned completely, and the chemical ash fused and drained to the dissolving tank. The gases produced by the combustion travel counter to the liquor, passing from the smelter through the dryer, then through the waste-heat boiler and air heater to the disk evaporator, from which they are drawn through an induced-draft fan to the atmosphere. It is pointed out that the disk evaporator recovers substantially all of the solids contained in the flue gas through the washing action which it imparts. At the same time it permits reducing the gas temperatures to 200-300 deg. F. It is stated that the normal steam production with this system is in the neighborhood of 10,000 lb. per ton of pulp made, depending somewhat on variations in mill operation.

Gas Scrubber

For the wet washing of gases such as blast furnace gas, the Freyn Engineering Co., Chicago, Ill., has developed a new three-stage washer known as the "Multizone." Dust is removed by impingement and entrapment on water-wetted surfaces. Gas enters tangentially into the bottom zone where the heavier particles are thrown to the outside of the chamber and removed by adhesion to the wetted walls. It then passes upward through wetted wood hurdles, which are staggered in their vertical

alignment. In the third zone, at the top of the scrubber, the gas enters an annular drum where it splits in two streams and passes between vertical rubber vanes placed so as to form comparatively narrow concentric passages



Vertical section of three-stage gas scrubber

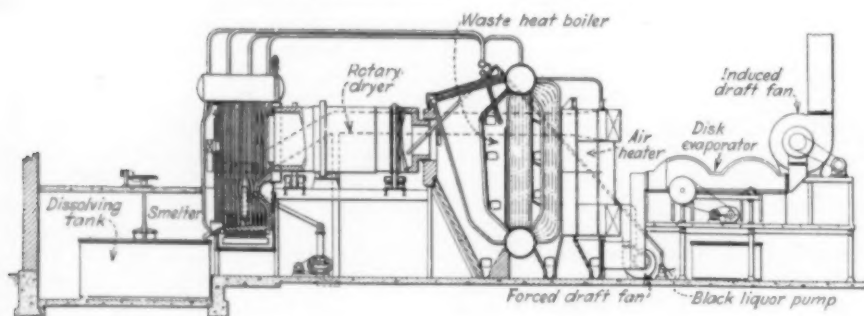
for the gas. These rubber surfaces are likewise wet, but in this case, the water is supplied from the entrainment carried by the gas itself. The result of the last cleaning stage is to remove 80 to 90 per cent of the dust remaining in the exit gas.

Vacuum Equipment

Goslin-Birmingham Mfg. Co., Birmingham, Ala., has introduced a new line of oil-sealed high vacuum pumps, together with new single- and two-stage vacuum ejectors. The pump is of the truly rotary type, without eccentric-shaped parts, cams or reciprocating elements. The internal parts are centered and revolve only. This construction is said to permit high speed without vibration, although even the smallest size operates at only 400 r.p.m. The pump is mounted on a base which serves as the reservoir for the lubricating and sealing oil, and which contains a cooling coil for maintaining the proper oil temperature and condensing any water vapor drawn into the pump. This line includes five sizes with displacements ranging from 12 to 200 cu.ft. of free air per minute, and capable of pumping down to a vacuum of a few microns.

The ejectors are of the steam-jet type, with high tensile-strength, cast-iron bodies and alloy nozzles. They range in size from 1½ to 6 in. suction, giving capacities from 75 to 800 cu.ft. of free air per minute, and producing vacuum of 26 in. in the single-stage model.

Murray-Waern system of black ash smelting with water-cooled smelter and waste-heat boiler



Semi-Metallic Packing

Combining shredded alloy lead of high lubricating qualities with asbestos, graphite and a variety of lubricants, Wm. B. Merrill & Co., 3368 Washington St., Boston, Mass., has developed a new semi-metallic packing known as "Tripplastic." The lead alloy shreds are said to be strong and ductile and at the same time curly so that they attach themselves to the fibrous constituents of the packing. The graphite is said to be of 98 per cent plus purity and the asbestos of very low silica content and of long fiber length. Seven different compositions have been developed to cover a wide variety of chemical applications. This packing is obtainable in five coil diameters to fit all sizes of stuffing box.

Color Analyzer

Designed for use with standard Munsell color disks, but operating on a principle quite different from previous color analyzers using these standards, the new H-S-B color analyzer, manufactured by Bausch & Lomb Optical Co., Rochester, N. Y., analyzes colors according to their



New H-S-B color analyzer

psychological attributes of hue, saturation and brilliance. This instrument is not a spectrophotometer. It is provided with a prism system with proper lenses, giving a circular photometric field divided vertically. Light for one-half of the field is reflected from the surface of the Munsell disks and for the other half from the surface of the sample to be measured. Illumination for both sample and disks is provided by means of specially designed lamp houses placed directly over each. The four lamps in each house are arranged on the corners of a square and the reflected beam passes up through the center of the square to the photometer.

Instead of the usual procedure of rotating the disks to secure integration of

the colors, the light reflected from the disks is passed through a prism which rotates, causing a circle to be scanned upon the disk surfaces. This operates at a speed sufficient to eliminate flicker. The advantage of this method is that it is no longer necessary to stop the motor while altering the sectors of the four disks. Instead, the result of each adjustment can be viewed as it is made, materially reducing the time required to secure a color match.

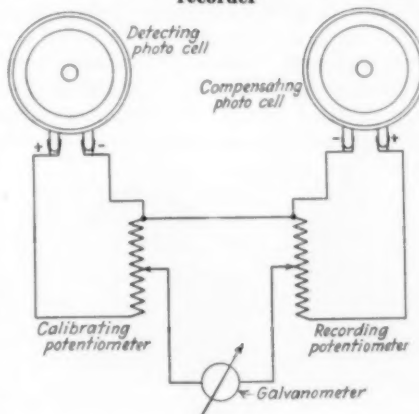
Turpentine Barrel Coater

Adapting its beer-barrel pitching machine to a new use, the Harnischfeger Corp., Milwaukee, Wis., has developed a machine for coating the inner surfaces of turpentine barrels with glue and thus reducing a previously tedious hand operation to a simple 15-second machine operation. The device employs a 70-gal. electrically heated glue pot on which the barrel is placed with the bung over a spindle. A revolving spray nozzle enters and thoroughly coats the inside with a brushlike effect. The glue pot is said to be insulated so thoroughly that glue is kept hot for about 34 hours after the heat is turned off.

Compensating Smoke Recorder

Changes in light source intensity, due to incandescent lamp deterioration or voltage fluctuation, are compensated in a new photoelectric smoke density recorder manufactured by the Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio. This compensation is accomplished through the use of two photocells, one of which receives the full light from the incandescent source while the other, placed on the opposite side of the stack breeching, receives the beam of light which has passed through the smoke. The negative terminals of the two photocells, which are of the sensitive disk type, delivering a current proportional to the illumination intensity, are connected together and the positive terminals con-

Circuit of compensating smoke-density recorder



nected back to the negative through potentiometers. Adjustment of the recording potentiometer is accomplished by means of a Galvatron which also operates the recorder pen. Whenever the smoke density changes, this adjustment takes place until the voltage drop in the two potentiometers is identical and no current flows through the galvanometer. Any variation in light source intensity affects both photocells similarly with the result that these variations are consequently ruled out, making possible accurate recording regardless of light source performance.

Non-Sparking Tools

An accompanying illustration shows a number of the Anaconda beryllium-copper non-sparking tools recently put on the market by the Stanley Rule & Level Plant, New Britain, Conn. These tools are recommended for use in all plants having fire and explosion hazards. By actual tests, it is stated, they are al-



Non-sparking tools of beryllium-copper

most as durable as steel tools of similar design and size. The alloy used, containing over 97 per cent copper, is hardened, toughened and strengthened by combined working and heat treating until its physical qualities are said to exceed those of any other non-ferrous metal. The metal is immune to rust and highly resistant to a wide variety of corrosive agents. Edged tools of this metal are said to possess long life and to be capable of cutting tough steel parts.

Integral Furnace Boiler

For industrial use, particularly where available headroom is limited, the Babcock & Wilcox Co., 85 Liberty St., New York City, has developed a new coordinated unit, combining a two-drum boiler, a water-cooled furnace, burners for any desired type of fuel and, when needed, a superheater, economizer and an air heater. The unit is designed for operation at high nominal ratings, with high final steam temperature and high efficiency.

Among advantages mentioned by the manufacturer are: low draft loss, often

permitting the use of natural draft and existing stacks; flexibility with regard to fuel, and the ability to change from one fuel to another without changes in boiler or furnace; and the use of water-cooled walls and floor and a slag screen.

Fluid-Control Valve

Hauck Manufacturing Co., 126 Tenth St., Brooklyn, N. Y., has announced the complete redesign of its Micro regulating valve, originally described in the August, 1930, issue of *Chem. & Met.* While it is intended primarily for the control of fuel oil flow, this valve is also suited to process fluids which must be regulated minutely. A principal feature of the new valve is the use of an opening indicator which permits returning to the identical setting at any time.

The close regulation of the new valve is obtained through a novel type of construction which includes a rotating, conical, plug-shaped gate, contain-



Improved fluid-control valve

ing a slot parallel to the axis, which rotates within a conical seat cylinder, in which is a tapered slot at right-angles to the slot in the plug. As the plug is rotated, the area exposed by the crossed slots can be adjusted to any size between zero and a maximum. A handle attached to the plug carries a pointer operating on a scale to permit accurate adjustment of the setting.

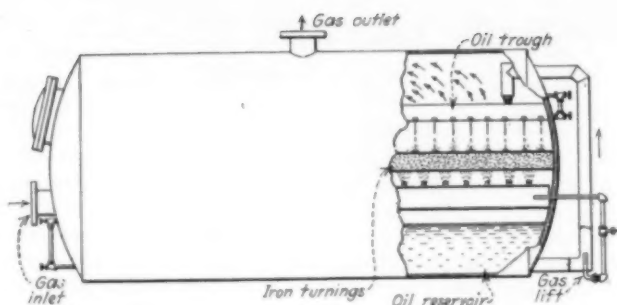
These valves are built in sizes ranging from $\frac{1}{8}$ to 1 in., having typical capacities, at 25 lb. pressure drop, of from 0 to 14 gal. per hour of light oil for the smallest valve, to 0 to 1,500 gal. for the largest valve.

Asbestos Rod Packing

For packing both reciprocating and centrifugal rods, Johns-Manville, 22 East 40th St., New York City, has announced a new product known as Interlocked braided asbestos packing. The new packing is braided square, rather than pressed into shape, and assures more contact area. Each individual strand of long-fiber asbestos yarn is said to be interlocked in the braiding so as

B-T gas cleaner Type 2, shown in section

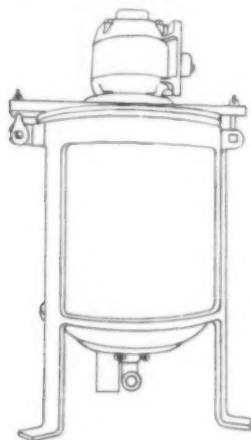
Cleaning oil is continuously circulated by a gas lift over an iron-turnings filter bed



to provide a completely integral braided structure with greater resiliency and flexibility. The new packing is recommended for use with steam, fresh or salt water, weak caustics and acids.

Acid-Proof Mixer

For small process work and for laboratory use, the Patterson Foundry & Machine Co., East Liverpool, Ohio, has developed a new acid-proof, sanitary mixer, made in sizes of 6 and 12 gal. It is called the "Poromixer" and is made of a white ceramic material known as Porox which is glazed inside and out and provided with a Monel metal outlet valve, flush with the bottom inside. The mixer is equipped with a Patterson direct-drive "Unipower"



New "Poromixer" for small scale production

agitator, driven at 1,200 r.p.m. The stirrer shaft and propellers are also made of Monel metal.

Advantages claimed for the new equipment include ease of cleaning and ease of disassembly. Furthermore, contamination of materials is said to be totally avoided.

New Gas Cleaners

Burrell-Mase Engineering Co., Law and Finance Bldg., Pittsburgh, Pa., has announced two new cleaners for removing dust and dirt from various types of fuel gas. B-T gas cleaner Type 2, shown in the accompanying illustration,

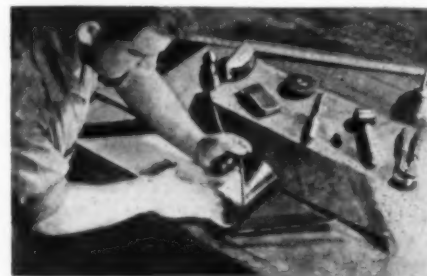
makes use of an oiled filter bed of iron turnings. The oil is continuously circulated from the reservoir in the bottom of the cylindrical shell to an oil trough near the top which distributes it over the turnings and continuously washes the accumulated dirt into the reservoir. The oil circulation is accomplished by the lifting pressure of the gas itself.

Because the filter bed cleans itself without creating an oil mist, no spray eliminating baffles are necessary. And because of the low resistance of the filter bed, large capacity is obtained in a comparatively small unit. For example, a unit 4 ft. in diameter and 14 ft. long will handle 1,800,000 cu.ft. of gas per hour at 250 lb. per sq.in. pressure. The device is obtainable in sizes to handle any quantity of gas.

B-T gas cleaner Type 3, for very large capacities and for cleaning gases containing large quantities of solids in suspension, operates on a somewhat different principle than the one illustrated, passing the gas through a number of fluid sprays, so that the dirt particles are entrained by the fluid droplets and removed to a settling basin.

Belt Improvements

Several advances in belt construction have recently been announced by the B. F. Goodrich Co., Akron, Ohio. One is a new method of making belts endless, recently perfected by the company's



Producing a "Plylock" belt joint

technical staff. This construction is known as the Plylock belt joint and is said to overcome any tendency for the outside seams to open during severe service. The seam is imbedded below the surface of the belt in such a position

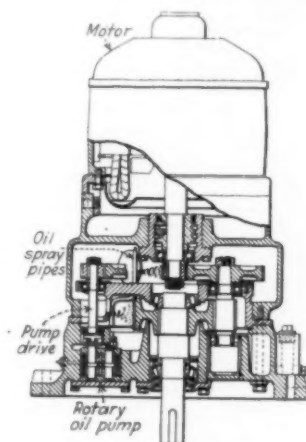
as to relieve it from strain and shield it from wear. The company intends to license its use among users and it will also be employed in all of the company's factory-built endless belts.

The "Golden Ply" hot material belt has also been introduced and is said to have a flexing life 85 per cent greater than that of regular grades of hot material belting, while its cover is said to offer far greater resistance to abrasion under prolonged exposure to heat. The new belt has withstood temperatures as high as 350 deg. F.

A new construction for multiple V-belts has been announced, wherein the three layers are balanced to resist stretch and cover wear. These belts are also compounded to minimize internal heat.

Vertical Motorized Reducer

An accompanying sectional drawing shows the construction of a motorized speed reducer built in both double and triple reduction units by the Falk Corporation, Milwaukee, Wis. The reducer shown is the IX type. Two other types, ZX and LX are also available. The ZX employs any standard horizontal ball



Cross section of vertical speed reducer

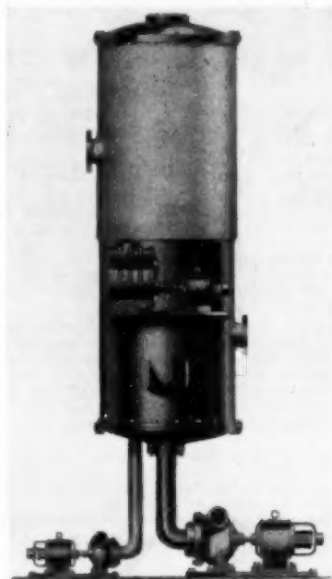
bearing motor while the LX (single-reduction only) employs an off-set, low-speed shaft.

These reducers are available in sizes from $\frac{1}{4}$ to 75 hp. The gears are of the single-helical type made of alloy steel. Either ball or roller bearings, as required, are employed. Lubrication is accomplished by pump pressure and spray piping. The design is such, it is said, that there is no possibility of oil leakage down the low-speed shaft.

Steam-Operated Cooler

For the production of cooled water at temperatures of 40 to 50 deg. F. and in capacities up to 15 tons of refrigeration, the Elliott Co., Pittsburgh, Pa., has de-

veloped a new unit steam-jet refrigerator of compact arrangement, containing within a single body an evaporating compartment, a steam-jet compressor and a condenser. Outside of the tank is a pump for removing and circulating the cooled water and another to remove the condensing water from the condensing compartment. An auxiliary motor-driven



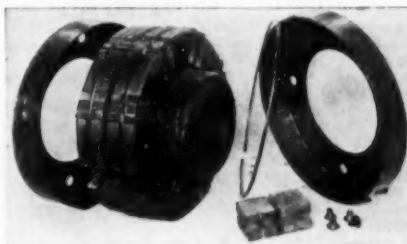
15-ton unit-type, steam-jet water cooler

vacuum pump is mounted on the side of the unit for the purpose of maintaining a moderately reduced pressure in the condensing compartment. The entire unit can be installed in a space less than 3 ft. sq. and 8 ft. high. Low pressure steam at any available pressure above atmospheric serves to operate the steam-jet.

Non-Lubricated Coupling

To provide a flexible shaft coupling which will compensate for slight misalignment without the requirement of periodic lubrication, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed a new coupling known as Type WH. It consists of two identical, cast-steel, flanged halves joined together with from 5 to 22 flexible elements, depending on size. This construction is made evident in the accom-

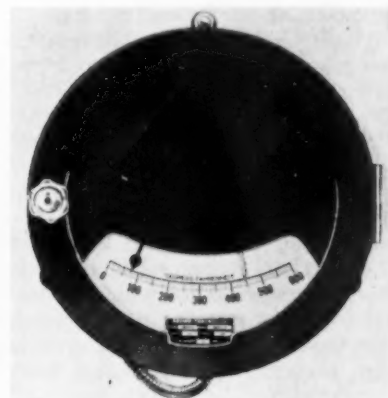
Disassembled flexible coupling



panying view which shows the torque-transmitting elements to consist of rectangular steel plates enclosed in cushioning elements made from high-grade hydraulic packing. The torque elements are held in the slots by means of retaining rings which snap into grooves and the whole assembly is covered with two sheet-steel cover plates. These present a smooth exterior and assure the safety of attendants.

Indicating Thermometer Controller

Following the type of construction employed in its recording, mercury-switch thermometer controller, the Brown Instrument Co., Philadelphia, Pa., has developed a new indicating controller. Every six seconds, a motor-driven control table determines the location of the pointer with reference to



New mercury-switch thermometer controller

the control setting, and tilts the mercury switch from one side to the other if the temperature has changed. Among the advantages for this construction, it is to be noted that the making of control contacts is independent of friction, while contacts are unaffected by vibration, because of the mechanical locking of the mercury switch.

The same construction may be employed in indicating controllers for pressure, liquid level and similar factors.

Equipment Briefs

Lewis-Shepard Co., Watertown Station, Boston, Mass., has announced a barrel stacker or portable elevator for all industries handling barrels and drums. The new stacker is equipped with holding strips on the platform to prevent the barrel from rolling off, and has a turntable to turn drums. It is equipped with removable rollers to handle cases and with platforms to rotate barrels. It is hinged for moving through doorways and under beams.

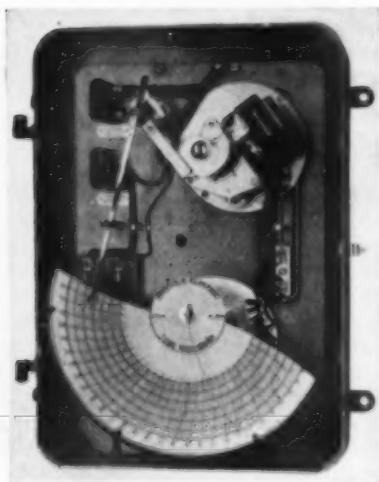
An improved cabinet or unit-weight type dormant platform scale recently announced by the Kron Co., Bridgeport, Conn., is equipped with from one to four unit weights which can be added to the weighing system by pressing down handles. Thus the scale capacity can be multiplied by two to five, if desired, to handle loads outside the normal range.

Henry A. Gardner Laboratory, 2201 New York Ave., N.W., Washington, D. C., has announced a new reflectometer and color comparator, which operates on the photometer principle. The two samples or a sample and a standard are illuminated by a single incandescent bulb placed between them. They are viewed simultaneously. By moving the lamp nearer one and farther from the other, a position of equal brilliance can be found and the comparative reflection determined. Another instrument developed by this laboratory gives a numerical reading for gloss, which is obtained independent of the diffuse or body reflection of the surface tested by means of the small, portable, self-contained photometer.

Spiral-Record Operation Recorder

In order to provide a long record on a fast-moving round chart, The Bristol Co., Waterbury, Conn., has devised a new operation recorder which draws a spiral curve, starting at the outer edge of the chart and gradually moving toward the center. This spiral record is accomplished by a Telechron cam which continuously resets the record-making movement. In a typical instrument, the record is a spiral curve covering eight rotations of the chart, over a period of eight hours, with $\frac{1}{4}$ -in. spacing between record lines and the operation record shown by $\frac{1}{16}$ -in. movements of the pen. The pen is actuated by a small electromagnet.

New spiral-record recorder



Autoclaves. Blaw-Knox Co., Pittsburgh, Pa.—Catalog 1482—20 pages on various types of autoclave made by this company. Also discusses high-temperature heating systems using organic heat transfer media.

Bakelite. The Bakelite Corp., Bound Brook, N. J.—24-page booklet discussing in a non-technical manner the application of Bakelite for the bonding of abrasive wheels.

Boilers. Babcock & Wilcox Co., 85 Liberty St., New York City—19 pages on a new integral-furnace boiler made by this company.

Conveyors. Stephens-Adamson Mfg. Co., Aurora, Ill.—16 pages completely describing the Redler conveyor-elevator made by this company; gives sizes and capacities and discusses applications.

Couplings. Parker Appliance Co., Cleveland, Ohio—Bulletin 37—July, 1934, price list of tube couplings and associated equipment made by this company.

Disintegration. Whiting Corp., Harvey, Ill.—Bulletin 13—3 pages on this company's air-separation impact pulverizers.

Dust Collection. Prat-Daniel Corp., 350 Fifth Ave., New York City—Bulletins describing this company's dust collecting fans and multiple-cyclone dust collectors.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—GEA-1979—10 pages on auto-transformer type reduced-voltage starters, for squirrel-cage induction motors.

Electrical Equipment. Roller-Smith Co., 233 Broadway, New York City—Catalog 10-A—4 pages on the Kathetron manual regulator for voltage control.

Electrical Equipment. Troy Engine & Machine Co., Troy, Pa.—Bulletin 107—32 pages with engineering data and detailed description of Troy-Engberg generating sets, employing vertical and horizontal steam engines.

Electrical Equipment. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Catalog Section 43-950—4 pages on Type LE photo-relays for a-c. and d-c. circuits.

Equipment. Alsop Engineering Corp., 39 West 60th St., New York City—Catalog 346—30 pages on liquid-handling equipment including filters, mixers, bottle fillers, pumps, glass-coated tanks, revolving tables and filtering asbestos.

Equipment. Baldwin-Southwark Corp., Philadelphia, Pa.—Bulletin 81—4 pages describing hydraulic presses for the manufacture of solid carbon dioxide.

Equipment. Blaw-Knox Co., Pittsburgh, Pa.—Form 1480—Illustrates range of equipment made in copper by this company.

Equipment. Patterson Foundry & Machine Co., East Liverpool, Ohio—Catalog 341—80 pages describing a complete line of clay-working machinery.

Equipment. Roller-Smith Co., 233 Broadway, New York City—Catalog 240—8 pages describing precision balances made by this company.

Equipment. United States Pipe & Foundry Co., Burlington, N. J.—20 pages on this company's Webre vacuum pans with mechanical circulation.

Equipment. United States Stoneware Co., Akron, Ohio—4-page article reprint describing the use of chemical stoneware in pumps.

Furnaces. Hevi Duty Electric Co., Milwaukee, Wis.—Bulletin HD-834—2 pages on high-temperature combustion-tube furnaces.

Instruments. The Brown Instrument Co., Philadelphia, Pa.—Catalog 6501—28 pages on hygrometers for recording and controlling humidity.

Instruments. Cambridge Instrument Co., Ltd., 45 Grosvenor Place, London, SW1, England—Folder 41—6 pages describing temperature control instruments made by this company.

Instruments. The Foxboro Co., Foxboro, Mass.—Bulletin 188—32 pages on recording and controlling instruments for humidity and drying processes.

Instruments. Industrial Engineers, Inc., 819-A East 59th St., Los Angeles, Calif.—Bulletin 1—8 pages on a new continuous automatic instrument for recording vapor pressure of petroleum products. Instrument is used for continuous records previously obtained intermittently by laboratory tests.

Instruments. Leeds & Northrup Co., 4961

Stenton Ave., Philadelphia, Pa.—Bulletin 842—12 pages on an instrument for the automatic control of furnace pressure.

Lubricants. Acheson Colloids Corp., Port Huron, Mich.—Technical Bulletin M-182—discusses the use of colloidal graphite lubricants in ball bearings.

Metals and Alloys. Cramp Brass & Iron Foundries Co., Paschall Station, Philadelphia, Pa.—6 pages announcing this company's production of P-M-G silicon bronze castings, forgings, rods and shapes.

Optical Apparatus. E. Leitz, Inc., 60 East 10th St., New York City—Catalog 52 B1—36 pages on a large micro-metallograph, Type MM-1.

Optical Instruments. Bausch & Lomb Optical Co., Rochester, N. Y.—26 pages describing a wide range of research microscopes; also price list and specifications for these microscopes.

Packing. Greene, Tweed & Co., 109 Duane St., New York City—Catalog 16—65 pages on packing; also covers tools, lubricators and belt fasteners.

Packing. Johns-Manville, 22 East 40th St., New York City—40-page booklet describing a wide range of packings covering more than 60 types with complete recommendation tables.

Power Transmission. D. O. James Mfg. Co., 1120 West Monroe St., Chicago, Ill.—Catalog 137—96 pages with engineering data, descriptions and illustrations on continuous-tooth herringbone speed reducers and gears.

Pumps. The Durlin Co., Dayton, Ohio—Bulletin 172—describes a new series of centrifugal pumps for acids and alkalis.

Respirators. Mine Safety Appliances Co., Pittsburgh, Pa.—Bulletin CR-1—4 pages describing this company's Comfo respirator, for protection against industrial dusts.

Safety Equipment. Mine Safety Appliances Co., Pittsburgh, Pa.—4-page folder describing the H-H inhalator for resuscitation of poisoning, shock and asphyxiation victims.

Scales. The Kron Co., Bridgeport, Conn.—16-page booklet describing the industrial dial scales made by this company.

Tanks. R. D. Cole Mfg. Co., Newnan, Ga.—15 pages illustrating the wide range of elevated water tanks and other fabricated equipment made by this company.

Tenite. Tennessee Eastman Corp., Kingsport, Tenn.—40-page booklet on Tenite, a thermoplastic cellulose acetate molding material; booklet describes uses, properties and molding technique.

Tools. Stanley Rule & Level Plant, New Britain, Conn.—4 pages describing the use of beryllium copper for non-sparking tools.

Traps. C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y.—Bulletin 1084—4 pages describing the recently improved thermostatic steam trap manufactured by this company.

Treads. Norton Co., Worcester, Mass.—Form 1604-1—Folder describing Alundum rubber-bonded safety treads for factory and other stairways.

Tubing. Steel & Tubes, Inc., 224 East 131st St., Cleveland, Ohio—Folder describing this company's Electronite "Steeltubes" electrical tubing.

Valves. Merco Nordstrom Valve Co., 400 Lexington St., Pittsburgh, Pa.—Bulletin V-102—Describes completely this company's new Emco-Nordstrom lubricated plug valve made in gate valve dimensions.

Water Still. U. S. Bottlers Machinery Co., 4015 North Rockwell St., Chicago, Ill.—15-page catalog describing this company's Polar water stills in industrial and laboratory types.

Welding. Ingersoll Steel & Disc Co., 310 South Michigan Ave., Chicago, Ill.—15 pages describing the welding and fabricating of Ingaclad stainless clad steel, containing much useful information.

Welding. The Lincoln Electric Co., Cleveland, Ohio—12-page book describing the Shielded Arc process of electric welding and the results attained; Specification Bulletin 30, 2 pages of general specifications for motor-driven welders.

Welding. Linde Air Products Co., 30 East 42d St., New York City—Publications as follows: Form 2238, 8 pages on progress in bronze welding; 2298, 24 pages on testing and qualification of welders; 2444, 8 pages on the use of welding in the maintenance of reciprocating parts.

NEWS OF THE INDUSTRY

New reciprocal trade agreement between United States and Cuba gives preferential customs treatment to U. S. shipments of various chemicals. World nitrogen cartel includes sales quotas for Chilean nitrate of soda. Supplemental code for industrial alcohol industry approved. NRA sets up new division to embrace codes for chemicals, drugs, paint, paper, and rubber.

Electrochemists Complete Plans for Fall Meeting

PREPARATIONS have been practically completed for the fall meeting of the Electrochemical Society, Inc., which will be held at the Hotel Pennsylvania, New York, Sept. 27-29. Registration will begin on the evening of Sept. 26. On the morning of Sept. 27 there will be a scientific-technical session on "The Electrochemistry of the Rarer Elements." James H. Critchett of the Electrometallurgical Co. will preside. After luncheon plant visits will be made to Bell Telephone Laboratories, New York, General Electric Vapor Lamp Co., Hoboken, and Philip Sievering, Inc., New York.

The morning of Sept. 28 will be devoted to a technical session which will include papers on the electrochemistry of life processes. The opening address will be given by Dr. Walter S. Landis of the American Cyanamid Co., third Joseph W. Richards Memorial lecturer. Luncheon will be combined with the plant visits. Two trips have been arranged, one to the Public Service Electric & Gas Co., Kearny, N. J., with luncheon served at the plant. Later the plant of the Westinghouse Lamp Co., Bloomfield, will be visited. The alternate trip is to the General Ceramic Co., Keasbey, N. J., with luncheon at the Metuchen Inn as guests of the company; then to the hydrogenation plant of the

Standard Oil Development Co. at Bayway.

On Saturday morning, Sept. 29, a session on "Electrodeposition" will be held under the direction of President H. S. Lukens. This will be followed by the Young Engineers' Luncheon on the Hotel Pennsylvania roof, with S. D. Kirkpatrick, editor of *Chem. & Met.*, acting as toastmaster.

The local committee in charge of the meeting is headed by James A. Lee, managing editor of *Chem. & Met.*, with W. W. Winship of Thermal Syndicate, Ltd., as vice-chairman.

National Safety Council Plans Annual Congress

WITH "Let's Tell the World About Safety" as their slogan, some 6,000 to 8,000 delegates will convene in Cleveland, Oct. 1-5 for the Twenty-third Annual Safety Congress and Exposition. They will represent industrial, educational, civic and official bodies from all parts of the United States and several foreign countries.

The official program, just issued by the National Safety Council, shows a total of 120 sessions and more than 350 speakers. Separate programs have been prepared for almost every branch of industry, thus making the Congress in effect a joint safety convention of some 30 different groups. In order to complete this vast program in the short

space of five days the facilities of three hotels will be taxed to the utmost, and it will be necessary at times to run as many as fourteen sessions concurrently. The Congress hotels are The Cleveland, The Carter and The Statler.

An interesting program has been developed for the Chemical Section. It follows: Monday afternoon, Oct. 1, "Our Objectives—Past, Present and Future," General Chairman John Roach, Deputy Commissioner of Labor, Trenton, N. J.; "Helping New Employees to Avoid Injury in the Chemical Industry," S. D. Kirkpatrick, editor, *Chemical and Metallurgical Engineering*; "Using Our Statistics to Advantage," G. H. Miller, Asst. Mgr., Safety & Fire Protection, E. I. du Pont de Nemours & Co., Wilmington, Del.; "The Importance of Maintenance and Repair Work in the Chemical Industry," Albert Vaksdal, Plant Eng., Corning Glass Works, Corning, N. Y.

Wednesday morning, Oct. 3, "Proper Protective Equipment for the Chemical Industry," F. J. O'Connor, Supt., Service Dept., Dye Works, E. I. du Pont de Nemours & Co., Deepwater Point, N. J.; "Safety in Unloading Tank Cars—Methods and Protection," A. C. White, Technical Sales Div., The Dow Chemical Co., Midland, Mich.; Election of Officers; Round Table Discussion: "Preventing Injuries to the Hands and Feet of Workers in the Chemical Industry." Led by A. L. Armstrong, General Supvr. of Safety and Fire Protection, Eastman Kodak Co., Rochester, N. Y.

Zinc Dust Production in Canada Expanding

PRODUCTION of zinc dust for the British Columbia market has been carried on for some time by the Consolidated Mining & Smelting Co. at Trail, B. C. The firm has now decided to enlarge its plant to take care of requirements in this line throughout the whole of the Dominion. Zinc dust totalling 1,044,800 lb. and valued at \$61,633 was shipped into Canada last year by foreign producers, and of this amount 636,800 lb. worth \$27,000 was consumed in British Columbia.

In Canada zinc dust is largely used as a precipitant in the cyanide process of gold recovery and also in paper manufacturing plants and in the dyeing and chemical industries. The current monthly consumption in Canada is approximately 48,000 lb.

Incidentally the Consolidated Mining and Smelting Co. has commenced work on extension of its storage building in its Warfield fertilizer plant. The addition will increase the storage capacity by 15,000 tons, making the completed capacity of the structure 80,000 tons.

World Nitrogen Fertilizer Cartel Formed

A CARTEL agreement between European producers of synthetic nitrogen fertilizer and the Chilean natural nitrate industry was accepted at a conference held in London on July 27 and became effective recently, according to a report from Consul Sydney B. Redecker.

This agreement, which will run for one year, with possible renewal for a further period, embraces virtually all world producers of nitrogen fertilizer, with the exception of the United States, and has for its primary aim the general raising of world nitrogen prices to more remunerative levels.

Under the terms of the cartel world markets will be divided into two groups. The first group includes "protected countries," or those having a synthetic nitrogen industry, and hitherto organized as the European Synthetic Nitrogen Cartel. These countries include, in addition to Germany, England, and Norway, which operate as one related block, the Netherlands, Belgium, France, Italy, Czechoslovakia, and Poland. It is understood that Japan is loosely associated with the cartel but its participation is not important as yet since its nitrogen production is absorbed largely by the domestic market.

The second group includes all "non-protected" or "open" and "disputed" markets dependent upon imports.

In the case of the "protected" countries, Chile has been granted for the year ending June 30, 1935, a total sales quota equivalent to an increase of 20 per cent over its actual sales to these markets during 1933-34, or approximately 50,000 metric tons of nitrogen.

In the case of "unprotected" or open markets, the status quo is to be preserved as regards proportionate deliveries—each member of the cartel receiving as quota a percentage equivalent to that actually supplied each country during the past fertilizer year. Thus no definite quantities have been established for these markets. Sales to them by Chile and other members of the cartel organization will rise or fall in accordance with actual imports into the countries concerned.

An interesting feature of the agreement regarding sales quotas for the open markets is that the block of British, German, and Norwegian producers will receive a quota as one unit and may divide this among themselves according to their own arrangement without reference to other members of the cartel, the consul reported.

Adherence to the established quotas is enforced through the imposition of heavy penalties payable to other pact members by those whose deliveries may exceed the prescribed allotment.

Nitrogen prices in the "protected" markets will remain unchanged and imports will be sold at the price fixed to prevent underbidding or otherwise disturb the internal market situation. In "open" markets, however, new schedules of prices of an elastic nature will be gradually introduced, varying according to current market conditions in each country.

Supplemental Code for Industrial Alcohol

NATIONAL Recovery Administrator Hugh S. Johnson has announced approval of a supplemental code of fair competition for the industrial alcohol industry, a division of chemical manufacturing. Labor provisions of the parent code are retained.

In his letter to President Roosevelt giving a résumé of the code, the Administrator states that the labor provisions of the parent code are included in the supplemental code. In the matter of trade practices, he points out that some of the code's provisions are aimed at correcting destructive price competition existing in this industry and were given a great deal of consideration in order to harmonize them with Administration policy.

In the article relating to price filing, it is provided that "inasmuch as certain products of the hardwood distillation industry, namely, methyl alcohol for anti-freeze, are used for identical anti-freeze purposes, as ethyl, isopropyl and various types of methyl alcohol as covered by this code, the filing of prices on the last named products . . . is not to become effective until and unless a provision for the filing of prices of the above named products which are covered by the hardwood distillation industry code . . . are incorporated in that code. When this is accomplished, price filing under each code shall be exchanged . . ."

"Obviously," said the Administration, "the open filing of prices by the industrial alcohol industry on products which are directly competitive with almost identical products produced by the hardwood distillation industry would not be any aid to them in reducing or knowing about destructive price competition unless the open filing of prices were adopted also by the hardwood distillation industry for the products referred to. For the same reason, the other fair trade practices are not to become effective in respect to the products of the industrial alcohol industry which are competitive with methyl alcohol sold for anti-freeze by the hardwood distillation industry, unless the other trade practice provisions specified in the article are also adopted by the hardwood distillation industry."

New Industrial Division Announced by NRA

THE National Recovery Administration has announced the formation of another industrial division in its organization set-up. Captain Joseph F. Battley, heretofore Deputy Administrator, will have charge of the new division as Acting Division Administrator. It will embrace the codes comprising chemicals, drugs, paints, paper and rubber in all of their various processings and forms of manufacture.

This action is in line with the policy of National Recovery Administrator Hugh S. Johnson to bring under one administrative head certain designated groups and their allied industries. In this re-classification and allocation, codes dealing with the chemical, drugs and paints industries will be assigned from Division No. 3; those dealing with paper and its products, also from Division No. 3, and rubber and its products from Division No. 1. As soon as the re-classifications and groupings are completed, the existing and the new divisions will be re-numbered.

In transferring the various codes to this and other new divisions, it is the purpose of the Administration to allow the personnel that has been handling them to remain intact. In the new division there will be approximately 138 codes, including supplemental codes. The construction code and its various industries will remain in Division No. 3 under Major George L. Berry.

Ceramic Conference at Penn State

"COLLOIDAL Problems in Ceramics" will be the subject of a two-day conference to be held at Pennsylvania State College on Oct. 5 and 6. Among the papers which will be presented are the following: "Progress in Soil Technology Resulting from Colloid Studies," Dr. Richard Bradfield, Professor of Agronomy, Ohio State University; "Problems in the Utilization of Pennsylvania Fire-clays," Dr. Fred Harvey, Director of Research, Harbison-Walker Refractories Co.; "Principles and Practice of Casting Refractory Shapes," Gordon Klein, ceramic engineer, New Castle Refractories Co.; "Fundamentals of Casting of Whiteware Bodies," T. A. Klinefelter, ceramic engineer, United States Bureau of Standards; "Plastic Flow in Nearly Dry Clay Bodies," Harry Thiemecke, Homer - Laughlin China Co.; "Modern Methods for the Determination of Fine Particle Sizes," J. A. Wagner, U. S. Bureau of Standards; "Metal Decoration for Ceramic Ware," Dr. J. H. Young, E. I. du Pont de Nemours Co.

GREAT interest is being manifest among employers in the settlement of the strike involving 8,500 employees of the Aluminum Co. of America. Union demands for the checkoff, uniform wages in all plants, discharge or advance to be contingent upon seniority, and that no agreement be entered into with individual employees were not granted. The new contract is "an agreement with all employees" and not with the union. A copy of the new agreement was mailed to each employee of the company. There was no question as to whether the union constitutes a majority of the employees. The company always has been willing to discuss working conditions with representatives of the unions or any other representative of its workers, as well as with individual employees. In the agreement the principle of collective bargaining was accepted by the company. Conditions under which the working force would be reduced in case of necessity were set forth. An orderly method was prescribed for the handling of grievances of any employee.

Specifications for tank cars and high pressure vessels were discussed at an Interstate Commerce Commission hearing in Washington September 7. It was developed that there is no present intention of forbidding the future construction of riveted tanks. Representatives of the manufacturers of welded tanks recommended the adoption of the specifications prepared by the American Railway Association tank car committee. The specifications considered for welded tanks follow closely the Class 1 requirements of the American Society of Mechanical Engineers for unfired pressure vessels. The Manufacturing Chemists Association was represented at the hearing by George E. Tilley, chairman of its tank car committee; Robert Marshall, J. C. Maguire and H. J. Gronemeyer.

Foreign Trade Agreements

The State Department has served notice that it is planning to negotiate a trade agreement with Belgium and Sweden. A public hearing in connection with commodities involved in the Belgium treaty will be held Oct. 29. The hearing on the Swedish agreement will be held Nov. 5. Briefs must be filed and applications for appearance must be made prior to noon Oct. 22, in connection with the Belgium agreement and before noon October 29 in connection with the Swedish agreement. The chief interest of the chemical industry in the Belgium agreement is possible action that may be taken with regard to sodium phosphate, lithopone, naval stores, benzol, coal-tar products, carbon black, paints, phosphate rock, varnish, gums and resins, creosote and fertilizer ingredients.

NEWS FROM WASHINGTON

By PAUL WOOTON

*Washington Correspondent
of Chem. & Met.*



Agreements also are being negotiated with Colombia, Haiti, Brazil, Costa Rico, El Salvador, Guatemala, Honduras and Nicaragua. Chemicals are not an important part of the trade with those countries, although Brazil is a large importer of sodium compounds.

The chemical manufacturing code containing provisions that are practically the same as the merit clause in the automobile code does not have to be renewed periodically as does the automobile code.

Conferences between producers and importers of potash and nitrogen products are in progress, at the time of this writing, in an effort to work out a sub-code of fair trade practices covering the activities of those two groups. Apparently differences have arisen between them which are insurmountable.

Federal funds are being sought for the construction of a tung oil crushing plant in the Picayune area of Mississippi where there has been a large and promising development of tung trees. A subsistence homestead project in connection with the plant also is being discussed. These plans have been stimulated by the large yield of tung nuts this season and the assurance that an important new industry has come into being. It is believed that the plant can be used also for the crushing of soya beans. With the employment which will come from the gathering of the tung nuts, an excellent basis is formed for the establishment of a subsistence homestead project where the workers can raise their own fruits and vegetables. While the tung trees in the South are just coming into bearing, large yields are reported from the groves at Poplarville and Bogaloussa, as well as those at Picayune.

Special Chemical Adviser

For the first time in the history of the Treasury Department the Secretary has retained a special adviser in chemi-

cal matters. Under the title "Consulting Chemist in the Office of the Secretary of the Treasury" Herbert J. Wollner, of New York, will represent the secretary in matters pertaining to chemicals in the Bureau of Internal Revenue, the Public Health Service and the Bureau of Narcotics. The first task which Mr. Wollner is undertaking deals with the effort to develop paper and coverings for bottles which cannot be imitated as readily.

Mr. Wollner is a graduate of the Brooklyn Polytechnic Institute. For seven years after leaving college he was senior research chemist for the General Chemical Co. For the last three years he has been doing consulting work with an office in New York City.

The National Recovery Administration on Sept. 11 announced that the secondary aluminum industry Code Authority has submitted modifications of its code to provide for a budget and the basis of contribution to same by industry members. It also seeks termination of the exemption in Administrative Order X-36, under which firms are freed from contributing to expenses of any code except that covering their principal line of business. The total amount of the proposed budget is \$17,460. The basis of assessment is 50c. a net ton of finished secondary aluminum and its alloys, this to be paid monthly on shipments of the previous month.

Notice was given that any criticisms or information relating to the action of the Code Authority must be sent to Deputy Administrator W. A. Janssen, Commerce Department Building, before Sept. 24.

To bring about a closer coordination of research along related lines in the Department of Agriculture, Secretary Wallace has announced the transfer of the divisions of Soil Fertility and of Soil Microbiology from the Bureau of Chemistry and Soils to the Bureau of Plant Industry and the transfer of the Insecticide Division of the Bureau of Chemistry and Soils to the Bureau of Entomology and Plant Quarantine. The order became effective Sept. 1.

The Division of Soil Fertility conducts investigations on the rôle of fertilizer constituents and other substances in plant nutrition in cooperation with several of the State experiment stations. It also operates four field stations. The division is under the direction of Doctor Oswald Schreiner, who has been in the Department since 1902.

With the transfer of the Insecticide Division, all work by the Department on insecticides and fungicides is now consolidated in the recently created Bureau of Entomology and Plant Quarantine. Dr. R. C. Roark, who has been in the Department for 16 years, has had charge of the Division of Insecticides since 1928.

Large Attendance at A.C.S. Cleveland Meeting

CHARACTERISTIC of practically all technical and engineering gatherings of 1934, the autumn meeting of the American Chemical Society in Cleveland, Ohio, the week of Sept. 10, produced an over-flow attendance of more than 2,500 registrations with hundreds more in attendance. Dr. Hippolyte Gruener of Western Reserve University and dean of Cleveland chemists, presided as honorary chairman.

In the working sessions of the 17 divisions of the program, more than 500 papers and addresses were presented to the delegates from industrial laboratories, universities, technical schools and state and federal scientific services. Fourteen additional symposia brought together experts from Canada, England, Japan, Holland, and the United States to discuss mutual problems of organic and physical chemistry, of enzymes, of potash, of fertilizers and soils, of properties of coals, of the chemistry of fluorine, and of the modernizing of general chemistry courses.

Isolation of the rarest metal known, the radio-active element protactinium, accomplished on Labor Day in the Chicago laboratory of the Universal Oil Products Co., was announced by Dr. Aristid von Grosse, 29 year old University of Chicago chemist. A minute sample of the metal, visible only with the aid of a magnifying glass, was exhibited, crystallized on a fine tungsten wire sealed onto a small piece of glass.

Three Clevelanders, N. K. Chaney, V. C. Hamister, and S. W. Glass, all of the National Carbon Co., told how they had determined accurately the vaporization point of carbon; stated as their belief, founded on exhaustive tests, that carbon does not melt or boil, but passes directly from a solid to a gaseous state at approximately 3,810 deg. absolute temperature, now established as the exact sublimation point. Sublimation also occurs, it was pointed out, in solidified carbon dioxide, or dry ice, which passes directly from the solid to the gaseous state at 195 deg. absolute temperature, equivalent to 78 deg. below zero C. "In view of the increasing industrial importance of electric furnace operations at high temperatures," Dr. Chaney concluded, "this new reference point of 3,810 deg. will be of great convenience as a calibration point for all industrial high temperature measuring devices."

From the 2½ in. telescope of Galileo to a 20 ton, 200 in. telescope disc is a startling path along which research has traveled from the 17th century retraced historically and practically by J. C. Hostetter, director of development and research, Corning Glass Works, in dis-

cussing the making of large telescope mirrors. Pointing out this progress with illustrated explanations of the most fascinating stages which have brought it forward, Mr. Hostetter revealed the research which permitted the recent successful casting of a 200 in. telescope disc; declared that the success experienced justifies the expectation of building mirrors of even larger size; said that this recent progress presages a Renaissance in American optical glass making.

Discussing the property of certain solids like cellulose, starch, and proteins like gelatine to absorb water between their smallest particles, increasing in dimensions at the same time, Dr. J. R. Katz of the Sckerkundig Laboratorium, University of Amsterdam, showed how x-ray spectrography has been able to explain the phenomena of swelling, subscribing only in part to either of the two theories previously advanced, (1) that a solid solution of water would form in the solid substance, (2) that the solid substance itself consists of very small crystals on whose surfaces the water is adsorbed, penetrating between the crystals rather than into them. The use of x-ray spectrography has demonstrated the incompleteness of both these theories; has disclosed a third category—that in which water is bound as water of crystallization within the crystals themselves.

Monday's general session was followed by a dinner at which Dr. Charles Lee Reese, taking his farewell as the Society's retiring president, stressed the fact that in science, research must accompany teaching to prevent the instructor from becoming a mere pedagogue, to keep his own mind from degenerating into mere machine routine and from losing touch with the advances in his own profession. Concluding he called the roll of the great chemistry teachers and researchers of the past, those who were instrumental in bringing about the "new era" in the chemical and allied industries or who were leaders in organized industrial research. The Society's award of \$1,000 for excellence in pure chemistry, initiated by Dr. Alfred C. Langmuir, was presented to Dr. C. Frederick Koelsch, young University of Minnesota researcher in organic chemistry.

The Council Committee on N.R.A. codes appointed at the St. Petersburg, Florida, meeting last March reported that consideration in Washington of a proposed code of fair competition for commercial testing laboratories had been dropped; that the N.R.A. had advised the sponsors of the code that no further consideration could be given it. Dr. Charles L. Parsons, Secretary of the Society, reported that the organization had enjoyed one of its most successful years; able, without subsidy, to pay

all of its obligations and to show a small surplus; that as of September first it had a total of 15,335 paid memberships.

A smoker and entertainment Tuesday evening, an orchestral and choral concert on Wednesday evening, and visits to Cleveland and Akron plants on Thursday afternoon and all day Friday combined to make the general program unusually attractive.

The next meeting of the Society will be held in New York in the spring, with the autumn meeting scheduled for San Francisco. The spring meeting of 1936 will be held in Kansas City, Mo.; the autumn gathering of 1936 going to Pittsburgh.

Census Data on Production Of Pyroxylin Plastics

PRODUCTION of pyroxylin plastics in the United States in 1933, according to preliminary data collected at the Biennial Census of Manufactures taken in 1934, totaled a value of \$12,103,048 in 1933, compared with \$17,659,104 in 1931, the previous census year. Comparative data follow:

Pyroxylin Plastic ¹ —Production, by Quantity and Value: 1933 and 1931		
	1933	1931
Number of establishments	12	12
Total production, lb.	12,934,569	15,009,769
Made and consumed in the same establishments, lb.	2,849,523	3,001,330
For sale in form for further manufacture: Lb.	10,085,046	12,008,439
Value:	\$7,799,283	\$11,113,618
Finished articles of pyroxylin made in the producing establishments in the "Chemicals, not elsewhere classified" industry, value.	² \$4,303,765	\$6,545,486

¹Not including photographic films.

²In addition, fabricated articles valued at \$716,591 were made by pyroxylin-producing establishments in other industries.

Electroplating Conferences Scheduled for Sept. 26

CONFERENCES on electroplating will be held at the Pennsylvania Hotel, New York, on Sept. 26 under the auspices of committees of the American Electroplaters' Society and the American Society for Testing Materials. The date selected is the day preceding the meeting of the Electrochemical Society, members of which are invited to attend.

The morning conference will be devoted to a discussion of proposed specifications for plating of nickel, chromium, zinc, and cadmium on steel. In the afternoon there will be a discussion of proposed program for exposure tests of plating on non-ferrous metals including copper, brass, zinc, and die castings.

Trade Agreement With Cuba Signed Aug. 24

THE new Reciprocal Trade Agreement between Cuba and the United States was signed in Washington, Friday, Aug. 24. The Agreement became effective ten days after signature. Unless terminated under special provisions of the agreement, it will remain in effect for a period of three years and thereafter until denounced by either country upon six months' notice. It accords exclusive and preferential customs treatment to a large list of products of each country imported into the other, and supersedes, during its duration, the Reciprocity Treaty of 1902.

Cuba, in return for valuable concessions for its sugar, rum, tobacco and off-season fruits and vegetables has granted the United States increased tariff advantages on most of those commodities which have been of outstanding interest to our exporters to Cuba. Chief among these are such American agricultural products as lard, salt and smoked meats, vegetable oils, wheat flour, rice, potatoes and onions, feed-stuffs, and lumber, which, upon their importation into Cuba, will receive substantial advantages in the form of increased preferences and/or reduced customs duties. In the field of manufactured products, Cuba's import duty concessions comprise a wide range of articles, including iron and steel products, hardware, textiles (especially rayon goods), automobiles (including accessories and tires), machinery in general, paper and cardboard, paints and varnishes, tennis shoes, incandescent lamps and electrical equipment in general, and others too numerous to mention in this brief analysis.

Unfavorable Prospects for Fertilizer Exports

A DISCOURAGING picture of world trade prospects for fertilizer chemicals is painted by Charles J. Brand, executive secretary, National Fertilizer Association, who has just returned from an economic survey of Europe.

Mr. Brand found that practically all European countries have sufficient nitrogen fixation capacity. The only new capacity being considered is one plant under construction in Italy and the report that Russia is likely to build another. He found that there were no new developments in production methods in the Old World, except that Germany is doing all possible to reduce costs and increase efficiency in order to meet world competition.

According to the observations of the Association's Secretary, Germany is

the most progressive in fertilizer chemical research and the nation most aggressive in world trade. He pointed out that despite present unfavorable conditions, the German potash industry is continuing agronomic research and experimental work. A serious world price war on this chemical with sales under cost was reported and Mr. Brand predicted that it would lead to a bad situation unless potash prices are stabilized soon. He believes that the recent price to American purchasers of as low as 37 cents per unit is distinctly below cost, and brought about solely by this struggle for markets.

In the case of superphosphates, the present exchange situation is making it impossible for Germany to take the quantities of American phosphate rock it might otherwise use. Under recent cartel laws, the German phosphate industry has been forbidden to increase capacity and was ordered, at the same time, to cut prices 5 per cent.

Power Show Scheduled for First Week in December

UNUSUAL mechanical exhibits are being planned for the Eleventh National Exposition of Power and Mechanical Engineering which will be held, Dec. 3-8, at Grand Central Palace, New York. The exposition is held at intervals of two years and the improvements in equipment and process made since 1932 will be shown at the forthcoming exposition. A calculated attendance of 40,000 is based on the fact that 38,000 visitors were registered at the last exposition and 36,000 at the one before that. The International Exposition Co., with Charles F. Roth again in personal charge, will direct the exposition and the time selected coincides with that of the midwinter meeting of the American Society of Mechanical Engineers.

CALENDAR

ELECTROCHEMICAL SOCIETY, fall meeting, New York, Sept. 27-29.

PAINT, VARNISH AND LACQUER ASSOCIATION, annual meeting, Washington, D. C., Oct. 31 to Nov. 3.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, fall meeting, Pittsburgh, Nov. 15-17.

AMERICAN PETROLEUM INSTITUTE, annual meeting, Dallas, Tex., Nov. 12-15.

NATIONAL EXPOSITION OF POWER, Grand Central Palace, New York, Dec. 3-8.

EXPOSITION OF CHEMICAL INDUSTRIES, New York, week of Dec. 2-7, 1935.

German I. G. Reports Favorable Business

IN a report from Frankfurt-on-Main, Consul Sydney B. Redecker states that in its quarterly statement, the I. G. Farbenindustrie, Germany's leading chemical producer, reports briefly regarding conditions in the second quarter of this year, avoiding all comment regarding the serious economic problems confronting Germany, such as the threatening shortage of raw materials, critical foreign exchange situation and the steady decline of foreign trade.

It is stated that the company's business developed favorably, and that supreme efforts were put forth to maintain exports despite all the difficulties. No details are divulged, however, regarding the success of these efforts or the remunerativeness of export trade. Further progress was achieved in the various trade branches of domestic industry. Gains in personnel were made through the addition of 4,000 employees to the payroll.

Trade in dyestuffs continued unchanged but industrial chemical sales expanded, due largely to increased domestic purchases. Domestic fertilizer sales were maintained but a further recession occurred in exports. Sales conditions for pharmaceuticals continued favorable in the domestic market, while intensified exports effort yielded favorable results in European countries.

Chemical Exports From Russia, Jan.-May, 1934

REPORTING on Russian export trade in chemicals for the first five months of this year, the Department of Commerce states that such shipments for the five-month period this year showed a decline in several classifications as compared with the corresponding period of 1933 but strict comparisons cannot be made for all items due to the inclusion of many new classifications for which trade statistics were not heretofore available. Particulars follow:

	Metric tons
Caustic soda	7,696
Soda ash	16,235
Sodium bicarbonate	2,419
Bleaching powder	5,056
Rosin	3,648
Bone glue	303
Skin glue	21
Red phosphorus	17
Silver nitrate	3.5
Alum	65
Formic acid	96
Chloroform	23
Terpineol	1.4
Aspirin	3
Salicylic acid	4
Calcium carbide	2,318
Acetic acid	353
Potassium bichromate	258
Sodium bichromate	760
Sodium sulphide	5,465
Sodium nitrite	15
Sodium hydrosulphite	45
Sodium thiosulphate	172
Dinitrochlorbenzene	77
Aniline salt	149
Superphosphate	3,888

NAMES IN THE NEWS

C. L. LOVELL has been appointed assistant professor of chemical engineering at Purdue University. Dr. Lovell goes to the Indiana institution from Iowa State University where he has been a member of the faculty of the chemical engineering department.

H. A. H. PRAY has been appointed an assistant physical chemist in Battelle Memorial Institute. From 1926 to 1933 Dr. Pray was professor of chemistry at West Virginia University.

R. S. PEOPLES, a graduate in metallurgical engineering from Ohio State University in 1933, has joined the staff of Battelle Memorial Institute.

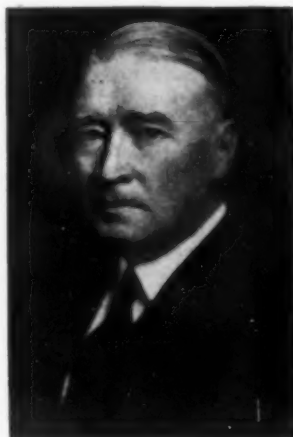
EDWARD ROSENDAHL, technical adviser of the Glyco Products Co., has been appointed vice-president and general manager. He was formerly professor of chemistry at Sassoon College, Baghdad, Irak.

HUGH MILLER, formerly associated with the National Aniline & Chemical Co. at Buffalo is now connected with the Selden Co. at Pittsburgh.

ALEXANDER C. BURR, of the department of chemical engineering, Massachusetts Institute of Technology, has been appointed dean of the faculty of Westminster College, New Wilmington, Pa. Prof. Burr joined the staff at the Institute in 1929, and for two years served as assistant to the late Prof. William P. Ryan. In 1933 he was appointed instructor. He was graduated from Jamestown College in 1920, and received a master's degree in 1922 at the University of Michigan. From 1924 to 1929 he was a member of the staff of the chemistry department at the College of the City of Detroit. He will assume his new duties in the fall.

J. C. REDMOND, a graduate of George Washington University, has joined the staff of the Battelle Memorial Institute, Columbus, Ohio. Mr. Redmond has previously been associated with the Bureau of Standards.

HENRY M. CHASE has retired from the engineering staff of the Worthington Pump & Machinery Corp. after 42 yr. of service. For many years he has been connected with improvements in design of pumping machinery.



John W. Finch

JOHN WELLINGTON FINCH, dean of the University of Idaho, has been named director of the Bureau of Mines succeeding Scott Turner.

OSCAR S. PULMAN has been elected president of Babson's Reports, Inc., Wellesley Hills, Mass., succeeding LEROY D. PEAVEY, retiring on account of ill-health. Dr. Pulman was graduated from the Massachusetts Institute of Technology in 1906 and for 14 yr. was employed by the National Carbon Co. as research chemist, assistant director of the research laboratory and as a staff executive at Cleveland. He assumed his new duties on September 4.

R. D. CENTER is now in the engineering division of Roessler & Hasslacher. He has returned to the duPont organization after an absence of ten years. In that period he was connected with the Krebs Pigment & Color Co. and National Aniline & Chemical Co.

HARRY A. NOYES has been appointed managing director of Applied Sugar Laboratories, Inc. He was selected for the position because of his broad and intimate knowledge of food processing, standardization and laws.

Z. NALBANDIAN, formerly connected with the Merrimac Chemical Co., Nitro Chemical Co., and Capes Viscose (now Dupont Rayon Co.) as research chemist, is now located with Warner Chemical Co.

JEPHTHA P. SANDERS, formerly employed by Dartmouth College, Burlington Mill Co., and the Ellis Labs., is now temporarily located with Warner Chemical Co. Mr. Sanders obtained his Ph.D. from Iowa State College.

HARVEY B. WILLIAMS, who was formerly employed by the Combustion Utilities Corp., is now located with the Fales Chemical Co. at Cornwall, N. Y.

L. F. MAREK, formerly acting director of the Research Laboratory of Applied Chemistry at M.I.T., has joined the staff of Arthur D. Little, Inc., Cambridge, Mass.

ALBERT T. FELLOWS of the Union Carbide & Carbon Research Laboratories has joined the Socony Vacuum Corp. and is located at Greenpoint, Staten Island, N. Y.

OBITUARY

EDWARD R. BERRY died in a hospital at Scranton, Pa., August 18. He was 55 yr. old.

Dr. Berry's name has long been associated with the development of fused clear quartz for which he was awarded the Grasselli medal for 1925 by the American Section of the Society of Chemical Industry. His research work done in the Thompson Research Laboratory of the General Electric Co., culminated in the announcement that a commercially practicable means of manufacturing the quartz had been devised. More recently Dr. Berry had been vice-president of the Inland Utilities, Inc., and a member of the board of directors of Crocker-Wheeler Electric Manufacturing Co.

HANS RICHARD HAERTEL died on July 19 at his home in Wrentham, Mass., after having suffered from heart trouble for several months. He had served the Rome Wire Co. as chemist, the Appleton Rubber Co. as chief chemist, and the F. S. Carr Co. as factory manager.

EDWARD A. W. EVERITT, died August 22 of a heart attack at his home in Dover, N. J. He was 63 yr. old. For many years Mr. Everitt was employed by the Hercules Powder Co. at its Kenil plant. He is credited with the development of Cordite.

RALPH M. SNELL, formerly vice-president of Paper Makers Chemical Corp., died in a sanatorium at Preston Springs, Ontario, on August 14. He was 57 yr. old. In 1907, Mr. Snell became associated with the company and in the next 24 yr. served it in many capacities, retiring in 1931. At the time of his death he was vice-president of the Hurlbert Paper Co. of South Lee, Mass.

Sales of Lead and Zinc Pigments Gained Last Year

IN AN advance summary the Bureau of Mines reports that sales of all lead pigments and of all zinc pigments registered important increases in 1933, the range being from 5 per cent for litharge to 60 per cent for leaded zinc oxide. Increases in sales of lead pigments in comparison with 1932 were as follows: basic lead sulphate, 27 per cent; red lead, 16 per cent; white lead—dry and in oil—and orange mineral, 9 per cent each; and litharge, 5 per cent.

Sales of zinc pigments and salts in comparison with 1932 showed the following increases: leaded zinc oxide, 60 per cent; zinc oxide, 36 per cent; lithopone, 16 per cent; zinc chloride, 37 per cent; and zinc sulphate, 34 per cent.

litharge, 72 per cent; lithopone, 71 per cent; zinc oxide, 64 per cent; red lead, 53 per cent; and white lead, 47.2 per cent.

Reports on sales of paint, varnish, and lacquer indicate a gain in distribution in 1933 of about 9 per cent over 1932, this comparison being based on valuation. The following tables show the distribution of lead and zinc pigments by industries in 1933 and 1932:

Average prices for all lead pigments were higher in 1933 than in 1932 but the reverse was true of the zinc pigments which may have some bearing on the fact that sales of the zinc products increased relatively more than those for the lead products.

The increase in sales of lithopone in 1933 over the preceding year was especially noteworthy but there was a considerable margin between sales and productive capacity, as the latter was reported to be 233,000 tons. However all the accompanying data for lithopone and for the other lead and zinc pigments refer to sales and not to production nor do the totals include the amounts made and consumed in the same establishments.

With regard to foreign trade the summary states that imports of lead pigments are negligible. Exports of white lead dropped from 1,681 tons in 1932 to 1,048 tons in 1933 while exports of red lead increased from 493 tons to 570 tons and of litharge from 1,493 tons to 1,538 tons.

Imports of zinc oxide declined from 2,672 tons in 1932 to 2,541 tons in 1933, while imports of lithopone increased from 4,724 tons to 5,096 tons and of zinc sulphide dropped from 33 tons to 11 tons. Imports of zinc chloride increased from 251 tons to 556 tons and imports of zinc sulphate dropped from 131 tons to 84 tons.

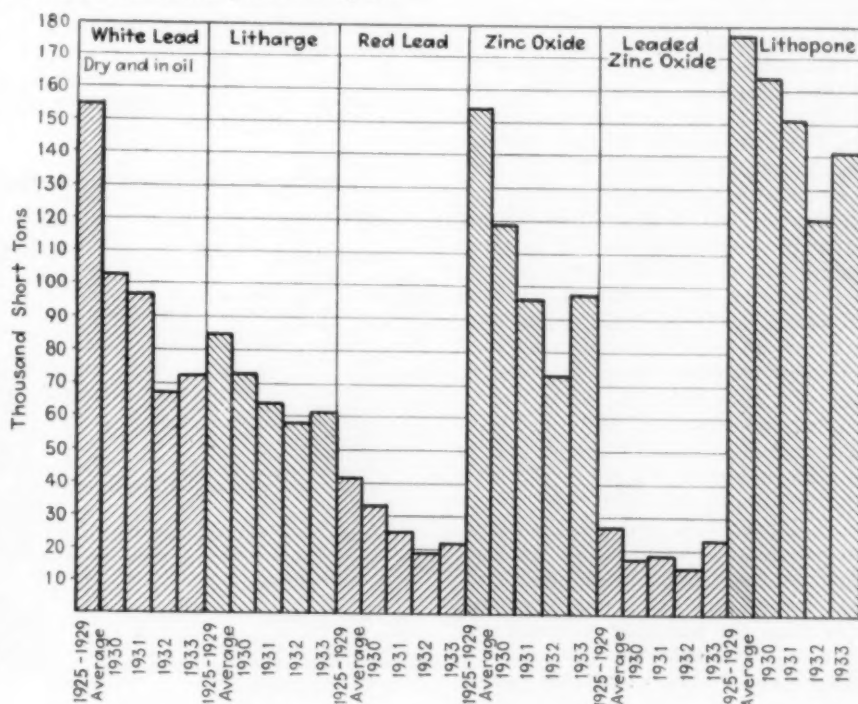
Sales of some lead and zinc pigments, by uses, 1932-1933

	1932 Short tons	1933 Short tons
White lead (dry and in oil)		
Paints	63,399	68,368
Ceramics	1,761	1,617
Other	1,514	2,997
	66,674	72,982
Red lead		
Storage batteries ..	10,655	12,949
Paints	6,389	7,182
Ceramics	467	715
Other	1,369	1,142
	18,880	21,988
Orange mineral		
Color pigments	108	96
Ink manufacture	58	18
Other	46	117
	212	231
Lithopone		
Paint, varnish and lacquers	93,465	106,995
Floor coverings and Textiles	17,601	18,472
Rubber	3,955	5,078
Other	6,646	10,286
	121,667	140,831
Basic lead sulphate		
Paints	5,689	7,072
Storage batteries ..	195	99
Rubber	77	161
Other	296	613
	6,257	7,945
Litharge		
Storage batteries...	29,365	27,327
Insecticides	11,735	11,126
Oil refining	4,793	6,070
Ceramics	2,963	5,438
Chrome pigments ..	2,591	3,973
Rubber	1,921	2,875
Varnish	1,360	610
Linoleum	169	106
Other	3,199	3,668
	58,096	61,193

Lead and zinc pigments and zinc salts sold by domestic manufacturers in the United States, 1932-33

	1932			1933		
	Short Tons	Value	Per Ton	Short Tons	Value	Per Ton
Basic lead sulphate or sublimed lead:						
White	5,708	\$534,369	\$94	7,320	\$736,404	\$101
Blue	549	34,125	62	625	65,525	105
Red lead	18,680	2,101,860	111	21,988	2,637,640	120
Orange mineral	212	37,691	178	231	45,928	199
Litharge	58,096	5,155,555	89	61,193	6,197,124	101
White lead:						
Dry	19,946	2,329,876	117	24,628	2,763,630	112
In oil	46,728	8,939,422	191	48,554	8,372,689	173
Zinc oxide	72,250	7,956,697	110	98,542	10,379,937	105
Leaded zinc oxide	14,305	1,296,076	91	22,868	2,011,761	88
Lithopone	121,667	10,176,856	84	140,831	11,751,500	83
Zinc chloride, 50° Baume	23,524	1,033,255	44	32,187	1,459,745	45
Zinc sulphate	4,252	138,476	33	5,698	221,780	39

¹ Weight of white lead only but value of paste.



Compared with the average for the five-year period, 1925-1929, leaded zinc oxide again makes the best showing with 1933 sales representing 86 per cent of the total for the five-year period. Sales of the other lead and zinc pigments compared with the five-year average were:

CHEMICAL ECONOMICS

Summer decline in general manufacturing industry more than seasonal but production of chemicals suffered only moderate curtailment. Consuming demand now expanding despite the unfavorable position of a few large consuming branches. Reductions in producer stocks are expected to bring out more active trading movement in the latter part of the year.

MANUFACTURING activities in general industry are credited with a somewhat more than seasonal decline during the hot weather period. Employment, hours of work, and average weekly earnings declined more than seasonally in July, according to the monthly report of the National Industrial Conference Board. The number of wage earners employed decreased 2.9 per cent, total man-hours worked declined 6.5 per cent, and there was a decrease in pay-rolls of 6.5 per cent.

Manufacturing activity, as measured by total man-hours worked, declined 6.5 per cent from June, 1934, to July, 1934, to a level 8.2 per cent under that of July, 1933. Man-hours worked declined from June to July in 18 of 25 industries covered in the Conference Board's survey, the declines ranging from 0.3 per cent in leather tanning to 37.3 per cent in the iron and steel industry. In 9 of the industries the reduction in total man-hours was more than 6 per cent. On the other hand, in 7 industries total man-hours increased, as follows: in the paper and pulp industry, 0.4 per cent; chemical industry, 2.6 per cent; electrical manufacturing, 3.4 per cent; boot and shoe industry, 4.3 per cent; book and job printing, 5.1 per cent; furniture, 7.2 per cent; and meat packing, 10.6 per cent. The increases in these industries were contrary to usual seasonal movements in 3 industries and larger than the normally expected rise in the other 4 industries.

This summary bears out trade reports

which place the decline in chemical production as relatively less marked than that for general industry. In fact, some branches of chemical manufacture are reported to have held a uniform rate of operations for some months.

The marked gain in manufacturing activities in June and July last year, has tended to cut down the percentage gains of different commodities for the first seven months of this year as shown in the accompanying table. A year ago, however, production was stimulated by a desire to amass stocks prior to anticipated advances in prices. Consumption was not on a par with production and

as a result accumulations of stocks soon brought about a lowering in the rate of production. Current prospects favor a moderate gain in general industry for the last quarter of the year as compared with a year ago.

Sales of fertilizer tags for the first eight months of the calendar year in the 12 Southern States were 16 per cent larger than the sales for the first eight months of 1933; 37 per cent larger than the sales for the first eight months of 1932, but were considerably smaller than the sales for the first eight months of 1931.

Production of methanol for the first half of this year was reported at 2,029,392 gal. for crude and 5,162,344 gal. for synthetic. This compares with 1,410,883 gal. and 2,205,855 gal. respectively for the first six months of 1933.

The outlook for the tanning industry has improved with an announcement from Washington of a three-point program to dispose of surplus hides purchased by the government after Sept. 5. It embodies:

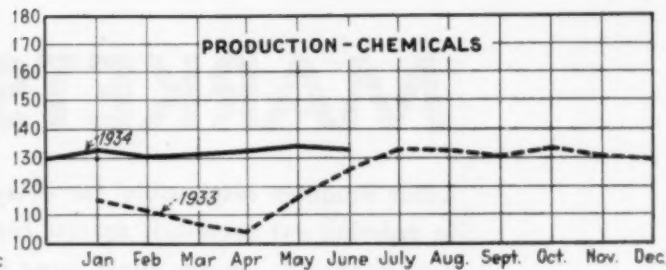
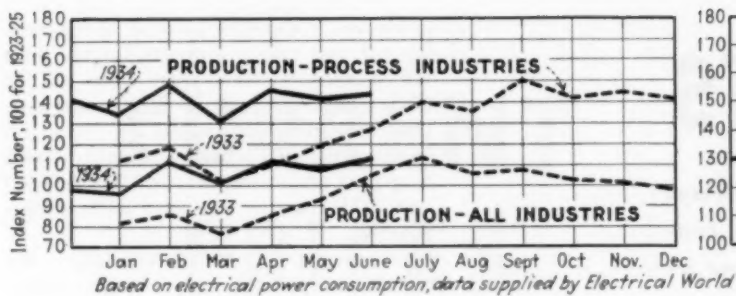
A plan that will not interfere with existing sales; a plan that will be confined entirely to relief operations, and a plan of orderly tanning of hides and the manufacture of whatever is needed in existing commercial plants and the distribution of the manufactured products to the unemployed, in such a way as will protect the present market fully.

In this connection the Tanners Council advised the industry: "The Washington Committee of Eight of the Tanners Council reports that the government is preparing bidding schedules for the contract tanning of all drought hides and skins taken off after Sept. 5. We are advised that the work will be done under competitive bids and that each member of the industry operating under the NRA will receive from the government a proper opportunity to bid for the work."

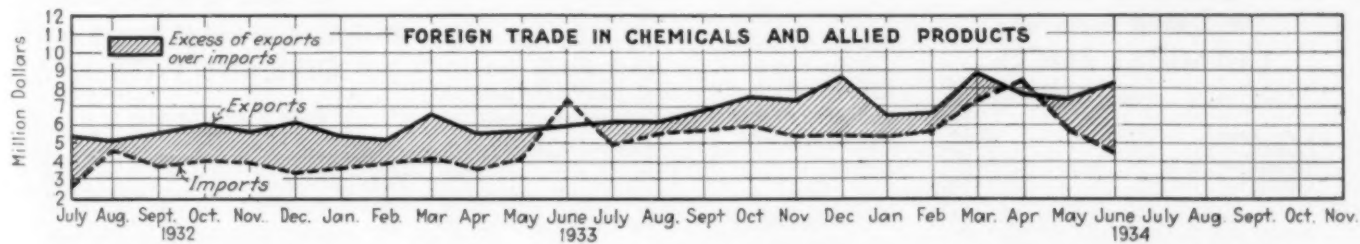
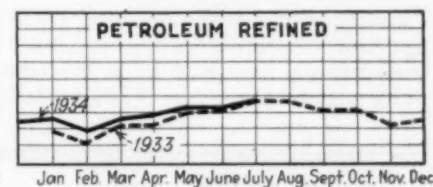
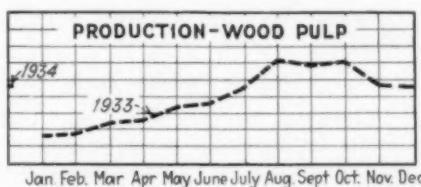
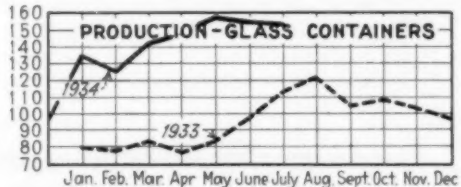
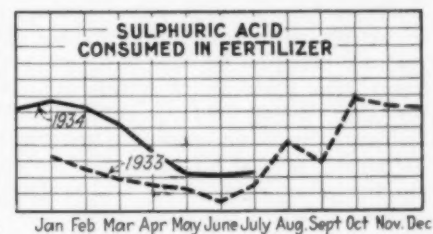
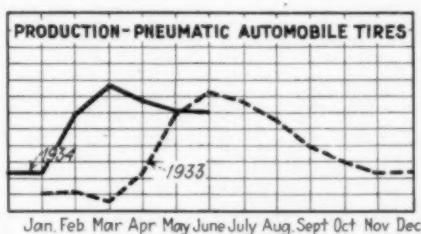
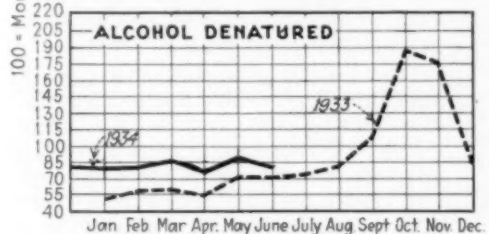
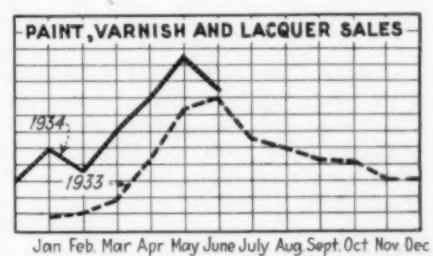
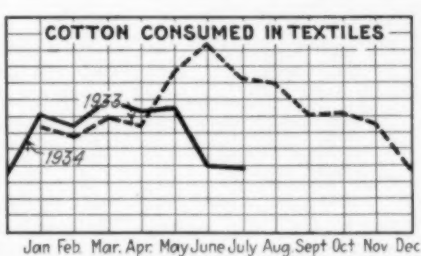
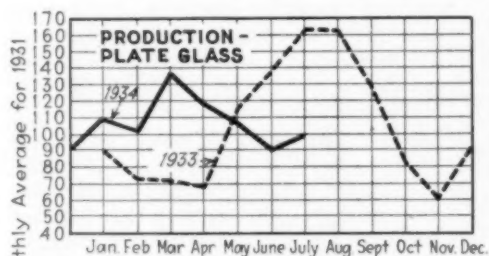
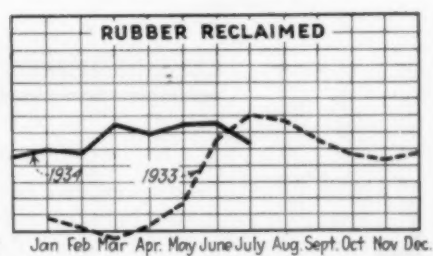
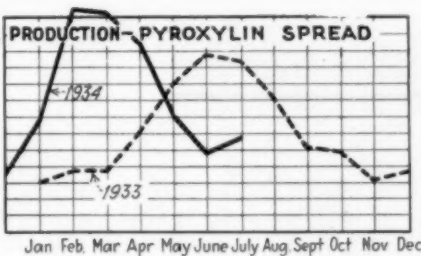
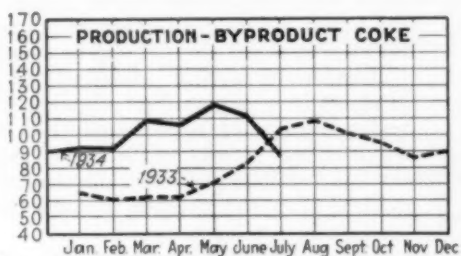
Production and Consumption Data for Chemical Consuming Industries

	July 1934	July 1933	Jan.-July 1934	Jan.-July 1933	Per Cent of Gain Jan.-July 1934
Production					
Automobiles, No.	266,357	229,357	1,980,914	1,227,371	62.1
Byproduct Coke, 1000 Tons	2,381	2,793	19,376	13,705	41.4
Cellulose-Acetate Plastics, Sheets, Rods, Tubes, 1000 Lb.	317	192	2,840	1,247	127.8
Nitro-cellulose Plastics, Sheets, Rods, Tubes, 1000 Lb.	715	1,228	7,385	5,639	31.0
Glass Containers, 1000 Gr.	3,117	2,322	20,551	12,515	66.6
Plate Glass, 1000 Sq. Ft.	7,242	11,350	55,131	49,477	11.4
Cottonseed Oil, Crude, 1000 Lb.	32,795	51,745	551,956	651,421	*15.3
Cottonseed Oil, Refined, 1000 Lb.	42,204	57,450	618,491	667,346	*7.3
Petroleum Refined, 1000 Bbl.	79,812	79,525	515,476	492,425	4.7
Pyroxylin Spread, 1000 Lb.	2,972	4,348	27,469	22,440	22.4
Steel Barrels, No.	598,745	623,056	4,429,043	3,330,483	32.9
Sulphuric Acid Produced in Fertilizer Trade, Tons	88,049	98,587	824,105	663,393	24.2
Rosin, Wood, Bbl.	37,037	41,033	304,004	215,535	41.0
Turpentine, Wood, Bbl.	5,547	6,516	49,860	34,294	45.4
Rubber Reclaimed, Tons	9,446	11,326	70,261	46,389	51.5
Consumption					
Cotton, 1000 Bales	359	601	3,285	3,795	*14.0
Silk, Bales	32,021	44,597	265,265	305,088	*13.1
Wool, 1000 Lb.	25,936	57,377	216,686	285,395	*31.7
Explosives, Sales, 1000 Lb.	23,384	23,834	181,198	127,515	42.1
Sulphuric Acid in Fertilizer Trade, Tons	83,079	71,951	799,823	530,437	50.8

*Per cent of decline.



TRENDS OF PRODUCTION AND CONSUMPTION



MARKETS

Labor troubles responsible for delays in ordering out chemicals against running contracts. Prices show some irregularity with potash salts and nitrate of soda easier and animal ammoniates firmer. Vegetable oils and animal fats continue on upward price trend. Processing tax applied to specified oils used since May 10.

LABOR troubles with particular reference to the textile industry have had an unfavorable effect upon the movement of raw materials including chemicals. This has been especially noted in withholding of shipping instructions on September deliveries against running contracts. Some of the other important consuming industries, however, have taken on larger stocks of raw materials since the turn of the month and prospects are reported as favoring further expansion in the final quarter of the year.

The price situation shows some irregularity with fertilizer chemicals attracting attention because of a new and lower sales schedule for nitrate of soda for the coming season and because foreign competition is holding the prices for potash salts at unusually low levels. On the other hand blood and tankage have been moved upward in price.

Apparently Germany is trying to hold the increase in potash sales reported for last year. A report to the Department of Commerce says that while the sales of the potash industry in 1932 amounted

to 850,000 tons of pure potash, a decline of 114,000 tons as against the preceding year, sales in 1933 again showed an advance. The increase in sales in 1933 as compared with the preceding year amounted to 87,000 tons of pure potash, or 10.24 per cent, and totalled 937,000 tons. Of this quantity 740,000 tons, or 79 per cent, were processed products, while the remainder was sold in the form of crude salts.

Forty-one potash mines were in operation in Germany during 1933, compared with 38 in the preceding year. In addition, five rock salt pits were in operation, and twenty potash factories participated in the production of potash products.

The higher rate of manufacture maintained by the fertilizer industry this year, naturally has been felt in a larger call for sulphuric acid and prices now obtained on sales of the acid in southern markets are considerably higher than those which were prevalent some time ago.

Gain in Foreign Trade

Chemical imports into the United States increased 29 per cent during the first six months of 1934 as compared with 1933, the Commerce Department announces. This increase was attributed mainly to increased industrial activity and heavier fertilizer consumption. Total imports during the first half year were valued at \$46,200,000 compared with \$35,900,000 for the corresponding 1933 period.

Exports of chemicals and related products during the period exceeded imports by \$14,670,000 compared with \$10,501,000 for the first six months of 1933.

Import statistics indicate that foreign

producers are still prominent in the market for salt cake. Imports for the first six months of the year were 46,242 long tons or a gain of 3,719 tons over the corresponding period of 1933. It is noted that Chile which supplied 7,646 long tons of our imports in 1933 shipped only 275 tons in the first half of this year.

Consumers of those vegetable oils which are subject to processing taxes have been disturbed by a ruling of the Bureau of Internal Revenue which makes the tax applicable to all oil used since the passage of the act on May 10. The fact that these oils were processed prior to May 10 did not affect the interpretation of the act. It is expected that large industrial users of oils will carry their opposition to this ruling to the courts, as payments have been made under protest and refunds will be sought.

Regulations permit manufacture of products from exported oil which is still under bond. If it is found that the goods cannot be sold on the export market, they may be placed on the domestic market after the necessary excise has been paid.

The President has approved the second report on synthetic camphor by the Tariff Commission which finds that no change is required in the rate of duty under the provisions of the Tariff Act. This provides that the duty of 5c. per lb. on synthetic camphor shall be reduced to 1c. per lb. if the domestic consumption is not supplied by domestic production to the extent of more than: 25 per cent for the six months ended June 17, 1933; 30 per cent for the six months ended June 17, 1934; 50 per cent for the six months ended June 17, 1935.

The Commission had found in its first investigation that domestic production during the first of the above periods substantially exceeded the 25 per cent specified in the law. The present report covering the second period shows that the domestic production of synthetic camphor greatly exceeded the 30 per cent specified in the law. The entire domestic output is by one manufacturer who started production in January, 1933.

CHEM. & MET. Weighted Index of CHEMICAL PRICES

Base = 100 for 1927

This month	87.51
Last month	87.61
September, 1933	86.09
September, 1932	84.56

Nitrate of soda, sulphate of ammonia and potash salts were prominent on the weak side of the market. Prices for most chemicals were unchanged and the index number was but slightly lowered.

CHEM. & MET. Weighted Index of Prices for OILS AND FATS

Base = 100 for 1927

This month	68.65
Last month	62.97
September, 1933	56.70
September, 1932	48.57

A general upswing was reported throughout the market for vegetable oils and animal fats and the index number for the month was higher than at any time since April 1931.

CURRENT PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Sept. 14.

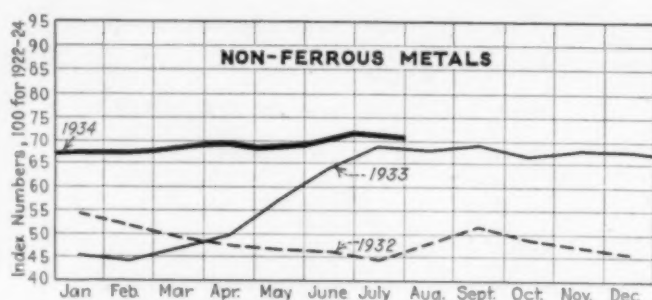
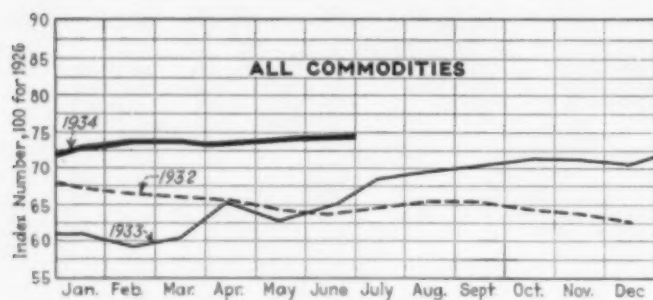
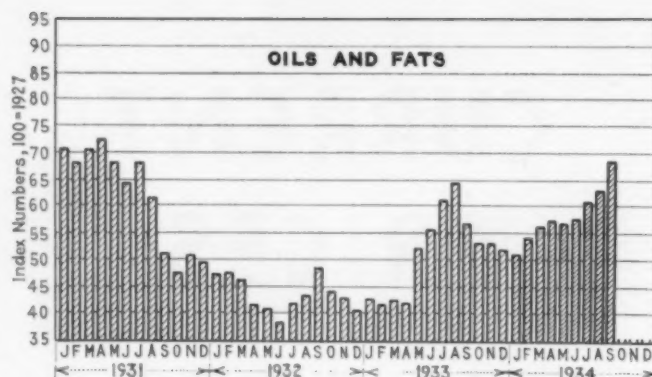
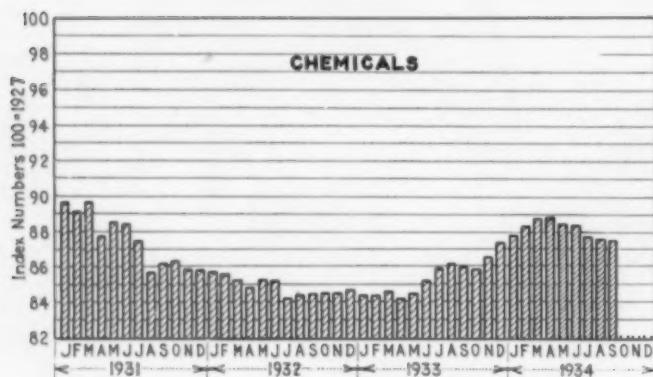
Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	\$0.11 - \$0.11	\$0.11 - \$0.11	\$.08 - \$0.09
Acid, acetic, 28%, bbl., cwt.	2.76 - 2.90	2.76 - 2.90	2.90 - 3.15
Glacial 99%, drums	9.13 - 9.38	9.13 - 9.38	10.02 - 10.27
U. S. P. reagent, c'bye	10.52 - 10.77	10.52 - 10.77	10.52 - 10.77
Boric, bbl., lb.	.04 - .05	.04 - .05	.04 - .05
Citric, kegs, lb.	.28 - .31	.28 - .31	.29 - .31
Formic, bbl., lb.	.11 - .11	.11 - .11	.11 - .11
Gallie, tech., bbl., lb.	.60 - .65	.60 - .65	.60 - .65
Hydrofluoric 30% carb. lb.	.07 - .07	.07 - .07	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11 - .12	.11 - .12	.11 - .12
22%, tech., light, bbl., lb.	.06 - .06	.05 - .06	.05 - .06
Muriatic 18% tanks, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Nitric, 36%, carboys, lb.	.05 - .05	.05 - .05	.05 - .05
Oleum, tanks, wks. ton.	18.50 - 20.00	18.50 - 20.00	18.50 - 20.00
Oxalic, crystals, bbl., lb.	.11 - .12	.11 - .12	.11 - .12
Phosphoric, tech., c'bye, lb.	.09 - .10	.09 - .10	.09 - .10
Sulphuric, 60% tanks, ton.	11.00 - 11.50	11.00 - 11.50	11.00 - 11.50
Sulphuric, 66% tanks, ton.	15.50 - 15.50	15.50 - 15.50	15.50 - 15.50
Tannic, tech., bbl., lb.	.23 - .35	.23 - .35	.23 - .35
Tartaric, powd., bbl., lb.	.25 - .26	.26 - .26	.24 - .25
Turpentine, bbl., lb.	1.40 - 1.50	1.40 - 1.50	1.40 - 1.50
Alcohol, Amyl.			
From Pentane, tanks, lb.	.143	.143	.15
Alcohol, B. tyl, tanks, lb.	.095	.095	.095
Alcohol, Ethyl, 190 p.f., bbl., gal	4.15	4.15	2.53
Denatured, 190 proof.			
No. 1 special, dr., gal.	.346	.346	.33
No. 5, 188 proof, dr., gal.	.34	.34	.34
Alum. ammonia, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Chrome, bbl., lb.	.04 - .05	.04 - .05	.04 - .05
Potash, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Aluminum sulphate, com., bags, cwt.	1.35 - 1.50	1.35 - 1.50	1.25 - 1.40
Iron free, bg., cwt.	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Aqua ammonia, 26%, drums lb.	.02 - .03	.02 - .03	.02 - .03
Ammonia, 66% tanks, lb.	.02 - .02	.02 - .02	.02 - .02
Ammonia, anhydrous, cyl., lb.	.15 - .16	.15 - .16	.15 - .15
Ammonium carbonate, powd. tech., casks, lb.	.08 - .12	.08 - .12	.08 - .12
Sulphate, wks. ton.	1.20 - 1.25	1.25 - 1.25	1.20 - 1.25
Amylacetate tech., tanks, lb., gal	.142	.142	.145
Antimony Oxide, bbl., lb.	.08 - .09	.08 - .09	.08 - .09
Arsenic, white, powd., bbl., lb.	.04 - .04	.04 - .04	.04 - .04
Red, powd., kegs, lb.	.15 - .15	.15 - .15	.13 - .14
Barium carbonate, bbl., ton.	56.50 - 58.00	56.50 - 58.00	56.50 - 58.00
Chloride, bbl., ton.	74.00 - 75.00	74.00 - 75.00	61.50 - 63.50
Nitrate, cask, lb.	.08 - .09	.08 - .09	.07 - .07
Blanc fixe, dry, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Bleaching powder, f.o.b., wks. drums, cwt.	1.85 - 2.00	1.85 - 2.00	1.75 - 2.00
Borax, grain, bags, ton.	40.00 - 45.00	40.00 - 45.00	40.00 - 45.00
Bromine, cs., lb.	.36 - .38	.36 - .38	.36 - .38
Calcium acetate, bags.	2.50 - 2.50	2.50 - 2.50	3.00 - 3.00
Amenate, dr., lb.	.05 - .07	.05 - .07	.07 - .08
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks. ton.	17.50 - 17.50	17.50 - 17.50	17.50 - 17.50
flake, dr., wks. ton.	19.50 - 19.50	19.50 - 19.50	19.50 - 19.50
Phosphate, bbl., lb.	.07 - .08	.07 - .08	.07 - .08
Carbon bisulphide, drums, lb.	.05 - .06	.05 - .06	.05 - .06
Tetrachloride drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chlorine, liquid, tanks, wks. lb.	.0185 - .0185	.0185 - .0185	.01 - .01
Cylinders.	.054 - .06	.054 - .06	.05 - .06
Cobalt oxide, cans, lb.	1.35 - 1.40	1.35 - 1.40	1.15 - 1.25

	Current Price	Last Month	Last Year
Copperas, bgs., f.o.b. wks. ton.	14.00 - 15.00	14.00 - 15.00	14.00 - 15.00
Copper carbonate, bbl., lb.	.08 - .16	.08 - .16	.08 - .16
Cyanide, tech., bbl., lb.	.37 - .38	.37 - .38	.39 - .44
Sulphate, bbl., cwt.	3.85 - 4.00	3.85 - 4.00	3.75 - 4.00
Cream of tartar, bbl., lb.	.18 - .19	.19 - .20	.17 - .18
Dietylene glycol, dr., lb.	.14 - .16	.14 - .16	.14 - .16
Epsom salt, dom., tech., bbl., cwt.	2.10 - 2.15	2.10 - 2.15	2.10 - 2.15
Imp., tech., bags, cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Ethyl acetate, drums, lb.	.08 - .08	.08 - .08	.08 - .08
Formaldehyde, 40%, bbl., lb.	.06 - .07	.06 - .07	.06 - .07
Furfural, dr., contract, lb.	.10 - .17	.10 - .17	.10 - .17
Fusel oil, crude, drums, gal.	.75 - .75	.75 - .75	.75 - .75
Refined, dr., gal.	1.25 - 1.30	1.25 - 1.30	1.25 - 1.30
Glauber's salt, bags, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Glycerine, c.p., drums, extra, lb.	.13 - .14	.13 - .14	.10 - .10
Lead:			
White, basic carbonate, dry casks, lb.	.06 - .06	.06 - .06	.06 - .06
White, basic sulphate, csk., lb.	.06 - .06	.06 - .06	.06 - .06
Red, dry, csk., lb.	.06 - .06	.06 - .06	.08 - .08
Lead acetate, white crys., bbl., lb.	.10 - .11	.10 - .11	.10 - .11
Lead arsenate, powd., bbl., lb.	.07 - .09	.07 - .09	.09 - .13
Lime, chem., bulk, ton.	8.50 - 8.50	8.50 - 8.50	8.50 - 8.50
Litharge, powd., csk., lb.	.05 - .05	.05 - .05	.07 - .07
Lithophone, bags, lb.	.04 - .05	.04 - .05	.04 - .05
Magnesium carb., tech., bags, lb.	.06 - .06	.06 - .06	.05 - .06
Methanol, 95%, tanks, gal.	.33 - .33	.33 - .33	.33 - .33
97%, tanks, gal.	.34 - .34	.34 - .34	.34 - .34
Synthetic, tanks, gal.	.35 - .35	.35 - .35	.35 - .35
Nickel salt, double, bbl., lb.	.11 - .12	.11 - .12	.12 - .12
Orange mineral, csk., lb.	.09 - .09	.09 - .09	.10 - .10
Phosphorus, red, cases, lb.	.44 - .45	.44 - .45	.45 - .46
Yellow, cases, lb.	.28 - .32	.28 - .32	.28 - .32
Potassium bichromate, casks, lb.	.07 - .08	.07 - .08	.07 - .08
Carbonate, 80-85%, calc. csk., lb.	.07 - .07	.07 - .07	.06 - .07
Chlorate, powd., lb.	.09 - .10	.09 - .10	.08 - .08
Hydroxide (caustic potash) dr., lb.	.07 - .07	.07 - .07	.07 - .07
Muriate, 80%, bgs., ton.	22.00 - 22.00	22.00 - 22.00	37.15 - 37.15
Nitrate, bbl., lb.	.05 - .06	.05 - .06	.05 - .06
Permanganate, drums, lb.	.18 - .19	.18 - .19	.17 - .18
Prussiate, yellow, casks, lb.	.18 - .19	.18 - .19	.16 - .17
Sal ammoniac, white, casks, lb.	.04 - .05	.04 - .05	.04 - .05
Salsoda, bbl., cwt.	1.00 - 1.05	1.00 - 1.05	.90 - .95
Salt cake, bulk, ton.	13.00 - 15.00	13.00 - 15.00	13.00 - 15.00
Soda ash, light, 58%, bags, contract, cwt.	1.23 - 1.23	1.23 - 1.23	1.20 - 1.20
Dense, bags, cwt.	1.25 - 1.25	1.25 - 1.25	1.22 - 1.22
Soda, caustic, 76%, solid, drums, contract, cwt.	2.60 - 3.00	2.60 - 3.00	2.50 - 2.75
Acetate, works, bbl., lb.	.04 - .05	.04 - .05	.04 - .05
Bicarbonate, bbl., cwt.	1.85 - 2.00	1.85 - 2.00	1.85 - 2.00
Bichromate, casks, lb.	.05 - .06	.05 - .06	.05 - .05
Bisulphate, bulk, ton.	14.00 - 16.00	14.00 - 16.00	14.00 - 16.00
Bisulphite, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Chloride, kegs, lb.	.06 - .06	.06 - .06	.05 - .07
Chloride, tech., ton.	12.00 - 14.75	12.00 - 14.75	12.00 - 14.00
Cyanide, cases, dom., lb.	.15 - .16	.15 - .16	.15 - .16
Fluoride, bbl., lb.	.07 - .08	.07 - .08	.07 - .08
Hyposulphite, bbl., lb.	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt.	3.25 - 3.40	3.25 - 3.40	3.25 - 3.40
Nitrate, bags, cwt.	1.275 - 1.275	1.35 - 1.35	1.295 - 1.295
Nitrite, casks, lb.	.07 - .08	.07 - .08	.07 - .08
Phosphate, dibasic, bbl., lb.	.02 - .023	.02 - .023	.02 - .023
Prussiate, yel. drums, lb.	.11 - .12	.11 - .12	.11 - .12
Silicate (40% dr.) wks. cwt.	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60-62%, dr., lb.	.02 - .03	.02 - .03	.02 - .03
Sulphite, cys., bbl., lb.	.02 - .02	.02 - .02	.03 - .03
Sulphur, crude at mine, bulk, ton	18.00 - 18.00	18.00 - 18.00	18.00 - 18.00
Chloride, dr., lb.	.03 - .04	.03 - .04	.03 - .04
Dioxide, cyl., lb.	.07 - .07	.07 - .07	.06 - .07
Flour, bag, cwt.	1.60 - 3.00	1.60 - 3.00	1.55 - 3.00
Tin Oxide, bbl., lb.	.56 - .56	.56 - .56	.50 - .50
Crystals, bbl., lb.	.38 - .38	.38 - .38	.35 - .35
Zinc chloride, gran., bbl., lb.	.05 - .06	.05 - .06	.05 - .06
Carbonate, bbl., lb.	.09 - .11	.09 - .11	.09 - .11
Cyanide, dr., lb.	.38 - .42	.38 - .42	.38 - .42
Dust, bbl., lb.	.07 - .07	.07 - .07	.07 - .07
Zinc oxide, lead free, bag, lb.	.06 - .06	.06 - .06	.05 - .05
5% lead sulphate, bags, lb.	.06 - .06	.06 - .06	.05 - .05
Sulphate, bbl., cwt.	2.75 - 3.00	2.75 - 3.00	3.00 - 3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	\$0.09 - \$0.10	\$0.09 - \$0.10	\$0.09 - \$0.10
Chinawood oil, bbl., lb.	.099	.09	.07
Coconut oil, Ceylon, tanks, N. Y. lb.	.02 - .02	.02 - .02	.03 - .03
Corn oil crude, tanks, (f.o.b. mill), lb.	.06 - .06	.05 - .05	.04 - .04
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.06 - .06	.05 - .05	.03 - .03
Linseed oil, raw ear lots, bbl., lb.	.095 - .095	.09 - .09	.10 - .10
Palm, Lagos, casks, lb.	.03 - .03	.03 - .03	.04 - .04
Palm Kernel, bbl., lb.	.03 - .03	.03 - .03	.04 - .04
Peanut oil, crude, tanks (mill), lb.	.06 - .06	.05 - .05	.04 - .04
Rapeseed oil, refined, bbl., gal.	.38 - .39	.37 - .38	.65 - .67
Soya bean, tank, lb.	.06 - .06	.06 - .06	.08 - .08
Sulphur (olive foots), bbl., lb.	.07 - .07	.07 - .07	.06 - .06
Cod, Newfoundland, bbl., gal.	.40 - .40	.40 - .40	nom.
Menhaden, light pressed, bbl., lb.	.053 - .053	.051 - .051	.053 - .053
Crude, tanks (f.o.b. factory), gal.	.22 - .22	.18 - .18	.17 - .17
Grease, yellow, loose, lb.	.04 - .04	.03 - .03	.02 - .02
Oleo stearine, lb.	.08 - .08	.06 - .06	.05 - .05
Red oil, distilled, d.p. bbl., lb.	.07 - .07	.07 - .07	.06 - .06
Tallow, extra, loose, lb.	.04 - .04	.04 - .04	.03 - .03



Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	\$0.60-\$0.65	\$0.60-\$0.65	\$0.60-\$0.62
Refined, bbl., lb.	.80-.85	.80-.85	.80-.85
Alpha-naphthylamine, bbl., lb.	.32-.34	.32-.34	.32-.34
Aniline oil, drums, extra, lb.	.14-.15	.14-.15	.14-.15
Aniline salts, bbl., lb.	.24-.25	.24-.25	.24-.25
Benzaldehyde, U.S.P., dr., lb.	1.10-1.25	1.10-1.25	1.10-1.25
Benzidine base, bbl., lb.	.65-.67	.65-.67	.65-.67
Benzoic acid, U.S.P., kgs, lb.	.48-.52	.48-.52	.48-.52
Benzyl chloride, tech., dr., lb.	.30-.35	.30-.35	.30-.35
Benzol, 90% tanks, works, gal.	.19-.20	.19-.20	.22-.23
Beta-naphthol, tech., drums, lb.	.22-.24	.22-.24	.22-.24
Cresol, U.S.P., dr., lb.	.11-.114	.11-.114	.104-.11
Cresylic acid, 97% dr., wks, gal.	.50-.51	.50-.51	.45-.46
Diethylaniline, dr., lb.	.55-.58	.55-.58	.55-.58
Dinitrophenol, bbl., lb.	.29-.30	.29-.30	.29-.30
Dinitrotoluen, bbl., lb.	.16-.17	.16-.17	.16-.17
Dip oil 25% dr., gal.	.23-.25	.23-.25	.23-.25
Diphenylamine, bbl., lb.	.38-.40	.38-.40	.38-.40
H-acid, bbl., lb.	.65-.70	.65-.70	.65-.70
Naphthalene, flake, bbl., lb.	.06-.07	.06-.07	.04-.05
Nitrobenzene, dr., lb.	.084-.09	.084-.09	.084-.10
Para-nitraniline, bbl., lb.	.51-.55	.51-.55	.51-.55
Phenol, U.S.P., drums, lb.	.14-.15	.14-.15	.14-.15
Pieric acid, bbl., lb.	.30-.40	.30-.40	.30-.40
Pyridine, dr., gal.	1.10-1.15	1.10-1.15	.90-.95
Resorcinol, tech., kgs, gal.	.65-.70	.65-.70	.65-.70
Salicylic acid, tech., bbl., lb.	.40-.42	.40-.42	.40-.42
Solvent naphtha, w.w., tanks, gal.	.26-.28	.26-.28	.26-.28
Tolidine, bbl., lb.	.88-.90	.88-.90	.88-.90
Toluene, tanks, works, gal.	.30-.32	.30-.32	.30-.32
Xylene, com. tanks, gal.	.26-.28	.26-.28	.26-.28

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton...	\$22.00-\$25.00	\$22.00-\$25.00	\$22.00-\$25.00
Casein, tech., bbl., lb.	.12-.13	.12-.13	.14-.15
China clay, dom., f.o.b. mine, ton	8.00-20.00	8.00-20.00	8.00-20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.04-.20	.04-.20	.024-.20
Prussian blue, bbl., lb.	.354-.37	.354-.37	.35-.36
Ultramarine blue, bbl., lb.	.06-.32	.06-.32	.06-.32
Chrome green, bbl., lb.	.26-.27	.26-.27	.27-.30
Carmine red, tins, lb.	4.00-4.40	4.00-4.40	3.65-3.75
Para toner, lb.	.80-.85	.80-.85	.75-.80
Vermilion, English, bbl., lb.	1.58-1.60	1.58-1.60	1.35-1.40
Chrome yellow, C. P., bbl., lb.	.15-.16	.15-.16	.15-.154
Feldspar, No. 1 (f.o.b. N.Y.), ton	6.50-7.50	6.50-7.50	6.50-7.50
Graphite, Ceylon, lump, bbl., lb.	.07-.084	.07-.084	.07-.084
Gum copal Congo, bags, lb.	.09-.10	.09-.10	.06-.08
Manila, bags, lb.	.09-.10	.09-.10	.16-.17
Damar, Batavia, cases, lb.	.154-.16	.154-.16	.16-.164
Kauri No. 1 cases, lb.	.20-.25	.20-.25	.45-.48
Kieselguhr (f.o.b. N.Y.), ton...	50.00-55.00	50.00-55.00	50.00-55.00
Magnesite, calc, ton.	50.00	50.00	40.00
Pumice stone, lump, bbl., lb.	.05-.07	.05-.08	.05-.07
Imported, caaks, lb.	.03-.40	.03-.40	.03-.35
Rosin, H., bbl.	5.60	5.55	5.25
Turpentine, gal.	.46	.48	.47
Shellac, orange, fine, bags, lb.	.35	.35	.24-.25
Bleached, bonedry, bags, lb.	.32-.33	.32	.24-.25
T. N. bags, lb.	.26-.27	.26-.27	.15-.16
Soapstone (f.o.b. Vt.), bags, ton	10.00-12.00	10.00-12.00	10.00-12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00-8.50	8.00-8.50	8.00-8.50
300 mesh (f.o.b. Ga.), ton.	7.50-10.00	7.50-10.00	7.50-11.00
225 mesh (f.o.b. N. Y.), ton.	13.75	13.75	13.75

INDUSTRIAL NOTES

THE BEMISS GUMMED TAPE CORP., manufacturers of gummed paper and cloth, operating a factory at 430 Main St., San Francisco, Calif., is under control of new owners and management. The name of the company has been changed to the Adhesive Products Corp., the new officers being Paul W. Shattuck, president; W. F. Harrison, vice-president and W. L. Shattuck, secretary and treasurer.

CELLULOID CORP., Newark, N. J., has appointed George H. Boehmer, general sales manager. R. S. Gavitt succeeds Mr. Boehmer as director of sales of the sheet, rod, and tube division and E. W. Ward succeeds Mr. Gavitt as manager of the Chicago office.

D. W. HARRING & CO., INC., Chicago, has appointed D. D. Morey of Dallas, Tex., as district manager of the New York office at 1451 Broadway.

PITTSBURGH PLATE GLASS CO., Pittsburgh, has acquired the business and property of

the Montana Glass & Paint Co., Butte, Mont.

LINK-BELT CO., Chicago, has promoted Harry L. Strube to the position of assistant chief engineer of the company's Philadelphia plant. He is succeeded as manager of the vibrating screen department by J. J. Richards.

ALLEGHENY STEEL CO., has promoted Russell M. Allen, formerly Chicago district manager, to the position of assistant general manager of sales with headquarters at the main offices in Brackenridge, Pa.

AMERICAN CYANAMID & CHEMICAL CORP., announces that the following companies in its group will be consolidated into and operated as divisions of American Cyanamid & Chemical Corp.: American Cyanamid Sales Co., American Powder Co., Catalytic Process Corp., Fumigation Service, Inc., Fumigators Supply Co., Inc., General Explosives Corp., Gypsteel Construction Co.,

Inc., Maryland Chemical Co., Inc., Owl Fumigating Corp., The Selden Co., The Selden Research & Engineering Corp., Structural Gypsum Corp.

STRUTHER-WELLS CO., Warren, Pa., has made W. T. Davidson manager of its machine parts division. Mr. Davidson formerly was in charge of the research and development work of the company.

EAGLE-PICHER SALES CO., wholly owned subsidiary of the Eagle-Picher Lead Co., Cincinnati, on Sept. 1 took over the sales and distribution of products manufactured by the Eagle-Picher Lead Co.

THE SIER-BATH CO., New York, has entered into a contract with the S-B Gear Corp. to manufacture the latter company's line of speed reducers.

UNION CARBIDE & CARBON research laboratories have been moved from Long Island City to Buffalo. B. E. Field is in charge.

NEW CONSTRUCTION

Where Plants Are Being Built in Process Industries

	Current Projects		Cumulative to Date	
	Proposed Work and Bids	Contracts Awarded	Proposed Work and Bids	Contracts Awarded
New England.....	\$28,000	\$85,000	\$1,163,000	\$1,340,000
Middle Atlantic.....	228,000	925,000	4,437,000	3,792,000
South.....	823,000	130,000	13,238,000	7,565,000
Middle West.....	357,000	625,000	8,807,000	1,851,000
West of Mississippi.....	89,000		15,588,000	909,000
Far West.....			3,352,000	1,277,000
Canada.....	300,000	250,000	3,580,000	1,646,000
Total.....	\$1,825,000	\$2,015,000	\$50,165,000	\$18,380,000

PROPOSED WORK BIDS ASKED

Distillery—Blue Ridge Distillers, Inc., c/o A. G. Weaver, Fort Royal, Va., have acquired a site here and plan to construct a distillery. Estimated cost \$100,000.

Distillery—Corporation, c/o Stuart Hamm, Charlottesville, Va., contemplates the construction of a distillery. Estimated cost \$100,000.

Distillery—O-Neh-Da Vineyard & Distillery Co., c/o Financial Security Corp., 521 5th Ave., New York, N. Y., plans to recondition its plant at Conesus, N. Y.

Distillery—Riverside Distillers & Brewers, Inc., Marine City, Mich., plan to construct a distillery here. Estimated cost exceeds \$60,000.

Distillery—Schenley Distillers, 20 West 40th St., New York, N. Y., plan to rebuild their distillery at Lexington, Ky. C. J. Kiefer, Schmidt Bldg., Cincinnati, O., is architect and engineer. Estimated cost \$150,000.

Gas Plant—City, Evansville, Ill., c/o City Clerk, is having plans prepared by Russell & Axon, Engrs., 4903 Delmar Blvd., St. Louis, Mo., for the construction of a gas plant and distribution system, including equipment. P.W.A. project. Estimated cost \$89,000.

Gas Plant—City, Fulton, Mo., c/o City Clerk, will soon take bids for the construction of a gas plant and distribution system. J. Frank Harrison, City Engr., Russell & Axon, 4903 Delmar Blvd., St. Louis, Mo., Cons. Engrs. P.W.A. project. Estimated cost \$98,500.

Gas Plant—City, Troy, Ala., is having plans prepared by Charles A. McKeand & Associates, Engrs., Troy, for the installation of a Butane-air gas plant and distribution system, designed to supply approximately 500 consumers. Distribution system includes about 68,000 ft. 3-, 3- and 4-in. cast iron mains. City will apply to Public Works Administration for funds for work.

Gas and Oil Development—Columbia Natural Gas & Oil Co. Ltd., Aston A. Winter, Pres., Hamilton, Ont., Can., plans a gas and oil development. Estimated cost \$300,000.

Electric Porcelain Plant—New Castle Refractories Co., New Castle, Pa., has acquired the plant of the former Kenilworth Tile Co., Newell, W. Va., and will remodel same and install equipment for the manufacture of electric porcelain. Estimated cost \$30,000.

Phosphate Plant—American Agricultural Chemical Co., 120 Lister Ave., Newark, N. J., plans the construction of a phosphate plant. Part of work is now under way. Estimated cost \$200,000.

Petroleum Development—Guardian Petroleum Development Co. Ltd., J. Bolema, Pres., Muskegon, Mich., plans a petroleum development at Windsor, Ont., Can. Estimated cost \$100,000.

Refinery—Old Dutch Refining Co., Inc., Muskegon, Mich., plans the construction of a 1,000 bbl. oil refinery in New Home Township, Montcalm Co., Mich., oil field. Estimated cost \$50,000.

Refinery—Peninsular Refining Corp., L. H. McIntire, Pres., Tampa, Fla., plans the construction of a refinery. Estimated cost including equipment \$335,000.

Refinery—Standard Oil Co. of Ohio, Lima, Ohio, plans to repair and alter its Solar Refinery, here. Estimated cost \$30,000.

Roofing Plant—Barrett Co., 40 Rector St., New York, N. Y., plans to rebuild its plant at Wylam (Sta. Ensley), Ala., recently damaged by fire. Estimated cost \$40,000.

Rubber Cement Plant—Braintree Rubber Cement Co., G. S. Reynolds, Mgr., South Braintree, Mass., plans to rebuild its plant recently destroyed by fire. Estimated cost will probably exceed \$28,000.

Tannery—J. Greenbaum Tanning Co., 4763 North 32nd St., Milwaukee, Wis., plans the construction of a 2-story, 70x120 ft. addition to plant. R. A. Kaupert, 2625 Greeley Ave., Milwaukee, Engr.

CONTRACTS AWARDED

Chemical Plant—Hughes-Mitchell Processes, Inc., Majestic Bldg., Denver, Colo., L. M. Hughes, Chn., Bd. Directors, awarded contract for chemical plant for treatment of lead and zinc ores, including manufacture of paint pigments, at 190th and Normandie Sts., Torrance, Calif., to Austin Co. of California, 777 East Washington St., Los Angeles. Estimated cost will exceed \$250,000.

Chemical Plant—Merck & Co., Lincoln Ave., Rahway, N. J., awarded contract for chemical plant to Salmond, Scrimshaw & Co., 526 Elm St., Arlington, N. J.

Clay Factory—Mississippi Clay Co., c/o J. W. Saunders, Charleston, Miss., awarded contract

for clay manufacturing plant to C. A. Hupp, De-fiance, Ohio. Estimated cost \$30,000.

Distillery—Clifton Distillery Co., 2500 West 25th St., Cleveland, O., W. B. Israel, Gen. Mgr., awarded contract for alterations to distillery to Max Lees, 2816 Mayfield Rd., Cleveland. Estimated cost \$50,000.

Distillery—David Hayes, 38 Victoria Rd., Hartford, Conn., will alter and equip a plant at Amston Lake, Hebron, Conn., for a distillery. Contract for masonry has been awarded to Peter A. Bell Co., 25 Abbottsford Ave., West Hartford, rest of work will be done by separate contracts under supervision of Mylchreest & Reynolds, Engrs., 238 Palm St., Hartford. Estimated cost exceeds \$28,500.

Distillery—J. E. Pepper Distillery, Lexington, Ky., awarded contract for rebuilding storage building and cooperage shop to Albert J. Lubrecht, Covington, Ky. Estimated cost exceeds \$100,000.

Distillery—Jos. E. Seagram & Sons, Lawrenceburg, Ind., are building a distillery under separate contracts. Contract for ten stills has been awarded to Ansonia Copper & Iron Works, 621 Evans St., Cincinnati, O. Estimated cost \$250,000.

Factory—Liquid Carbonic Canadian Corp., 41 Mill St., Toronto, Ont., Can., awarded contract for addition to plant for the manufacture of liquid carbonic gas and dry ice, to Charles Taylor, 42 St. Germain St., Toronto. Estimated cost \$150,000.

Fertilizer Plant—Farmers Fertilizer Co., Windsor Ave., Columbus, O., awarded contract for 1 story, 110x300 ft. factory to E. L. Prentice, 77 East Longview Ave., Columbus. Estimated cost \$52,000.

Laboratory—Gulf Refining Co., Gulf Bldg., Pittsburgh, Pa., awarded contract for group of three buildings to be used as research laboratory to W. T. Grange Construction Co., Keenan Bldg., Pittsburgh. Estimated cost \$200,000.

Laboratory—U. S. Department of Agriculture, Division of Purchases and Sales, Wash., D. C., awarded contract for construction of a 2 story, 62x102 ft. fruit products laboratory at the Horticultural Farm, Beltsville, Md., to North-eastern Construction Co., 6 West Madison St., Baltimore, Md. Estimated cost \$109,480.

Linoleum Factory—Congoleum-Nairn, Inc., Marcus Hook, Pa., awarded contract altering factory to Turner Construction Co., Graybar Bldg., New York, N. Y. Estimated cost exceeds \$50,000.

Paper Mill—Erving Paper Mills, Erving, Mass., Morris Housen, Mgr., awarded contract for 1 story, 80x80 ft. addition to paper mill, to P. J. Kennedy, Jr., Smith's Ferry, Mass.

Perfume Factory—Allied Products Co., Suffern, N. Y., awarded contract for addition to perfume factory, to Barney-Ahlers Construction Corp., 110 West 40th St., New York, N. Y. Estimated cost \$150,000.

Peroxide Factory—Canadian Industries, Ltd., 1050 Beaver Hall Hill, Montreal, Que., Can., awarded contract for addition to factory to Fraser-Brace Engineering Co., Ltd., 107 Craig St., Montreal. Estimated cost \$100,000.

Plant Addition—Linde Air Products Co., 7501 St. Aubin Ave., Detroit, Mich., awarded contract for addition to plant to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost \$35,000.

Refinery—Maxwell and Ray Lewis, Ovid, Mich., will build a 1,000 to 1,500 bbl. refinery at Elsie, Mich., by day labor under supervision of E. G. Guy, Engr., c/o owner. Estimated cost \$60,000.

Metal Treatment Plant—Raritan Copper Works, George Evans in charge, 25 Bway., New York, N. Y., will construct a metal treatment plant at Perth Amboy, N. J., under separate contracts.

Casting Shop—Revere Copper & Brass, Inc., 24 North Front St., New Bedford, Mass., awarded general contract for casting shop 1 story, 167x190 ft., to J. W. Bishop Co., 182 Sycamore St., New Bedford.

Tunnel Kilns—Cronin Pottery Co., Minerva, O., awarded contract for four new tunnel kilns, including necessary buildings to house same, to Ladd Cronin Engineering Co., New Cumberland, W. Va., and Columbus, O. Estimated cost \$150,000.

Soap Factory—Jno Hansen Soap Co., 3000 West Hampton Ave., Milwaukee, Wis., awarded contract for 2 story, 50x87 ft. soap factory, to D. Wiersma, North Ave. and Club Pl., Milwaukee.

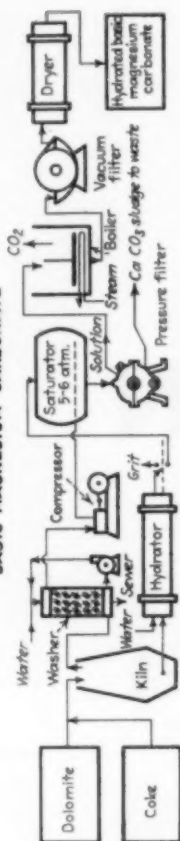
Storage Building—National Sugar Refining Co., 129 Front St., New York, N. Y., will build a storage plant at 2nd St. and 56th Ave., Long Island City, N. Y., under separate contracts. Estimated cost \$45,000.

Storage Building—O. Overholt & Co., Broad Ford, Pa., distillers, awarded contract for storage and distribution building addition, to Sander-son & Porter, 52 William St., New York, N. Y. Estimated cost \$250,000.

Warehouse—Chas. Lennig & Co., Inc., 5000 Richmond St., Philadelphia, Pa., awarded contract for warehouse building for chemical plant, to F. V. Warren & Co., Lewis Tower Bldg., Philadelphia, Pa. Estimated cost \$65,000.

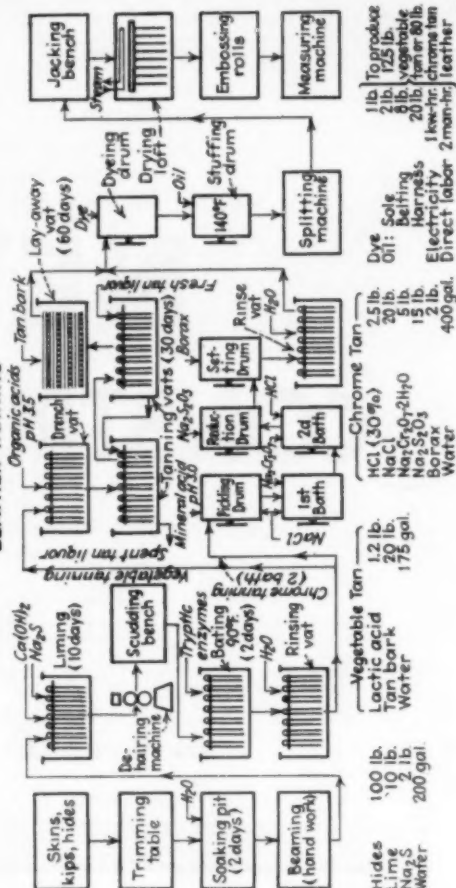
PROCESS INDUSTRIES

BASIC MAGNESIUM CARBONATE

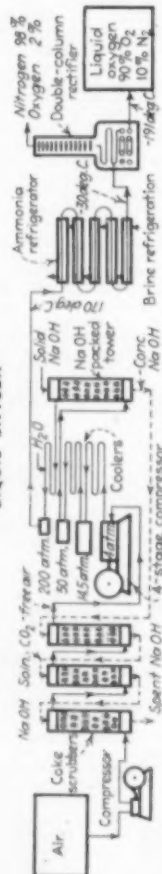


Note: some manufacturers press the wet basic carbonate into blocks which are then dried and ground. If the basic carbonate is to be used in "85 per cent magnesia" insulation, it is mixed before drying with asbestos fiber, after which it is moulaged into blocks and dried. The dried carbonate may be calcined if light burnt MgO is desired.

LEATHER TANNING

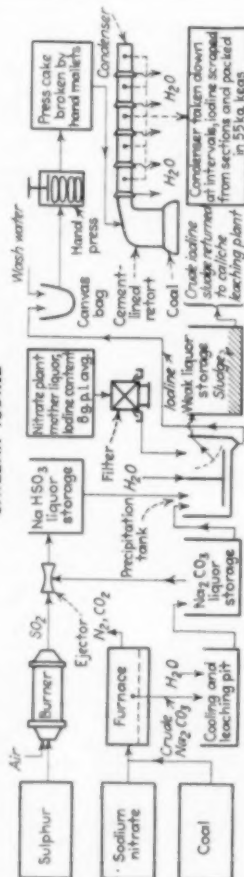


LIQUID OXYGEN



Air (20 deg. C.)	4,240 cu. ft.	Refrigeration (ice equiv.) Electricity Direct labor	0.5 tons 6 Kw-hr. 1 man-hr.	To produce 530 cu. ft. free O ₂ in one hour
Na OH	40 lb.			
Cooling water	1,000 gal.			

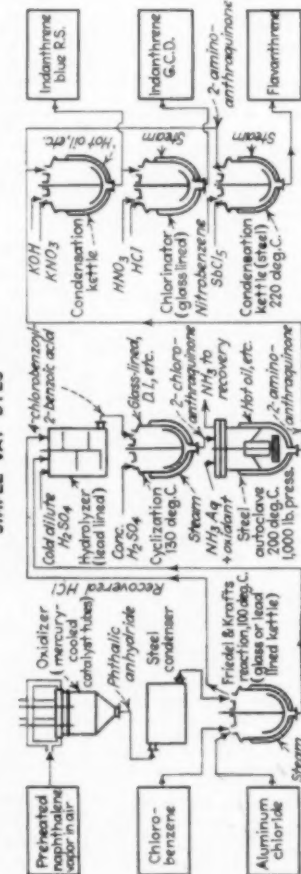
CHILEAN IODINE



Precipitation reaction: $2\text{NaIO}_3 + 5\text{NaHSO}_3 \rightarrow 3\text{NaHSO}_4 + 2\text{NaI} + 4\text{H}_2\text{O} + \text{I}_2$

Wet-ash liquor (8 g.p./l ₂ , 70 per cent yield)	2,140 gal.	Sodium nitrate	} To produce 100 lb. indine 99 per cent l ₂ variable 0.07 per cent ash 3 man-hr. 0.93 per cent H ₂ O
Sulphur	160 lb.	Water	
Coal (1/3 for carbonate, 2/3 for retort)	235 lb.	Direct labor	

SIMPLE VAT DYES



Malic anhydride	148 lb. } To produce 235 lb. 2-chloroanthraquinone 600 lb. }	235 lb. } To produce 200 lb. 2-aminoanthraquinone 1,500 lb. }
Benzene		

Flavanthrene batch #	2-aminoanthraquinone Caustic potash KNO ₃ (or K-acetate)	Indanthrene R.S. batch #
200 lb.	200 lb.	200 lb.
2,000 lb.	2,000 lb.	2,000 lb.
700 lb.	700 lb.	40 lb.

Indanthrene R.S.	Indanthrene G.C.D.	* yields variable
100 lb.	batch #	
180 lb.		
450 lb.		

* *violate variable*